Nova School of Business and Economics

Universidade Nova de Lisboa

Dissertation, presented as partial fulfilment of the requirements for the Degree of Doctor of Philosophy in Economics

Essays on corporate funding and bank lending relationships

Luciana da Graça de Sá Barbosa

Student Number 576

A Dissertation carried out on the Ph.D. Program in Economics, under the supervision of Professor Paulo Soares de Pinho

August 2016

Essays on corporate funding and bank lending relationships

Abstract

This dissertation comprises three essays on the corporate sector and its relationships with banking institutions, exploring detailed micro databases. The first Chapter explores the relevance of information underlying working capital and turnover indicators on the probability of default on a bank loan. The second Chapter investigates the main determinants of corporate funding. In addition to bank and trade credit, the analysis also sheds light on loans granted by shareholders or intra-group operations, and tax liabilities. The third Chapter explores firms' decisions on investment and employment through the vulnerability of their lenders to financial market developments, in the context of the euro area sovereign debt crisis.

Keywords: Credit risk; Funding structure; Banking relationships; Corporate decision.

Contents

List of Tables

List of Figures

Acknowledgments

"Eles não sabem, nem sonham,
que o sonho comanda a vida,
que sempre que um homem sonha
o mundo pula e avança
como bola colorida
entre as mãos de uma criança."

in Pedra Filosofal, António Gedeão

Doing a PhD and writing the dissertation is a long, challenging, and sometimes difficult project. Writing these few words on this page means that the journey is near its end. Looking back, the support and help of several persons were crucial. I would like to sincerely acknowledge them.

First of all, I express my gratitude to my advisor Paulo Soares de Pinho for his guidance, discussions, and insights during all the research period. I am also grateful to Miguel Ferreira for his helpful suggestions and fruitful discussions, and Charles Kahn for the discussions, suggestions, and support, mainly during my visit to the Financial Department of the University of Illinois.

I am also grateful to my colleagues at the Economics and Research Department of Banco de Portugal who have directly or indirectly helped me in this project,

especially to my colleagues in the Financial Stability/Intermediation Division. A kind word to Carlos Santos and Luísa Farinha. I am grateful to their encouragement, trust, and understanding of the difficulties of balancing work and a *PhD* project. I would also like to express my appreciation to Banco de Portugal for support and access to enumerable research materials. I am also thankful to Heitor Almeida, Rui Albuquerque, and Steven Ongena for the opportunity to discuss this work during their visits to Banco de Portugal.

I want also to extend my acknowledgments to my colleagues in the PhD Program, especially Ana Gouveia, Ana Rita Mateus, Daniel Carvalho, and Sara Serra. Their support and team work were crucial during this adventure. I am also thankful to António Antunes and Geraldo Cerqueiro for their constructive discussions and comments. A kind acknowledgment to Diana Bonfim, Hugo Reis, and Paula Antão for their useful suggestions, but mainly for their friendship and support to pursue the objective: *"a PhD is not a sprint run, it's more similar to a marathon"*.

My gratitude also goes to my family and friends for their encouragement, as well as their patience and comprehension of my absence in several events during this long journey. Finally, a deep gratitude to my Parents, Abel Barbosa and Maria dos Prazeres Barbosa, as well as my Grandmother Marília: Thank you for everything!

Luciana Barbosa

Lisbon, July 2016

Introduction

The three essays that comprise this dissertation focus on the corporate sector and its interaction with the banking system, exploring corporate credit risk, different firms' funding sources and constraints on firms' decisions in the context of the recent euro area sovereign debt crisis.

The first Chapter focuses on corporate credit risk regarding banking liabilities. In this Chapter we investigate if a deeper analysis of liquidity and turnover indicators contain additional insights regarding firms' probability of default. These variables are usually identified as relevant financial indicators in empirical literature. However, they may reflect different firms' operational activity and efficiency management. Therefore, we explore if the breakdown of working capital and turnover into variables related with cash holdings, activity indicators, investment turnover, and tax liabilities contains relevant information for determining a firm's probability of a bank credit default, controlling for other variables. According to the results, we observe that firms that take longer to repay their suppliers have higher probabilities of default. There is also evidence of a positive relationship between firms' credit risk and the share of tax liabilities. The results highlight the link between tax liabilities and accounts payable with firm's financial vulnerabilities, and their contribution in corporate credit risk analysis.

The second Chapter is related to corporate funding. Funding is crucial for firms

to invest but also to operate their daily business. Different types of debt have different characteristics and requirements for firms. Hence, it is important to improve the knowledge of firms' leverage, which is high in several European countries, and consequently identify potential vulnerabilities of firms to financial and economic developments. Against this background, the analysis presented in the second Chapter identifies the main determinants of the composition of corporate liabilities. In addition to bank and trade credit, two major external finance sources, we also include in the analysis tax liabilities and loans granted by shareholders or intra-group operations. The analysis of these components is not so well documented in the literature, but these sources seem to be particularly relevant in some firms' segments. The results obtained suggest that some firms' characteristics present a similar impact on the alternative funding sources, such as profitability, while others show a heterogeneous effects. Moreover, the results suggest the importance of variables related to firms' activity and business risk in their funding structures.

The third Chapter assesses empirically the interaction between firms' real decisions and the financial system. The recent financial and economic crises initiated a new wave of discussion about real and financial linkages, within both academics and policy-makers. The euro area sovereign debt crisis put the banking sector under great pressure and imposed several challenges, notably in countries most affected by the crisis. The sovereign-bank linkage, and the negative feedback loop, could negatively affect the economic activity, especially when firms tend to be bank-dependent. The analysis presented in this Chapter explores the heterogeneity across banks in their funding structures, sovereign exposures, solvency positions, and collateral availability to investigate the effect of the negative shock on firms' investment and employment decisions. This study uses detailed databases that cover virtually all bank loans granted to Portuguese firms for the period 2007-2012. The evidence suggests that firms whose lenders depend more heavily on interbank and financial markets funding show higher adjustments in investment and employment. The re-

sults also stress the importance of assets eligible as collateral in monetary operations. In turn, the exposures to sovereign debt securities and solvency positions provide weaker explanations for firms' outcomes. Broadly, the empirical results highlight how a deterioration in sovereign creditworthiness and the deterioration in financial markets may affect the real economy via the banking sector. Improved knowledge of this framework is crucial to identify the transmission channels across sectors, and consequently explore the potential impact of some political or institutional measures.

Chapter 1

Working capital and tax liabilities as determinants of corporate credit risk

Abstract: Liquidity and turnover indicators are usually mentioned as important dimensions in the corporate credit risk literature. However, these variables may reflect different firms' operational activity and efficiency management. This study explores if the breakdown of working capital and turnover into variables related to cash, activity indicators, investment, and tax liabilities contains relevant information in determining a firm's probability of a bank credit default event, controlling for other variables. According to the results, we observe that firms that take longer to repay their suppliers have higher probabilities of a credit default event. Moreover, there is evidence of a positive relationship between firms' credit risk and the share of tax liabilities. These indicators seem to be a signal about a firm's financial fragilities.

JEL Classification: G21, G33, C25

Keywords: Credit risk, Default probability, Corporate loans, Logit Model

1.1 Introduction

Corporate credit risk has received great interest in the financial and banking literature. In the banking perspective, the asymmetric information in the credit market between entrepreneurs and lenders is critical. For credit risk management, it is crucial to assess a firm's financial position and identify its vulnerabilities in order to determine the price of a loan, or to decide even about its approval (Stiglitz & Weiss (1981)). Afterwards, a careful monitoring of the firm's financial developments is also required, given the impact of default events on banks' provision and impairment policies, as well as on regulatory capital requirements. Over the last decade, there has been a renewed interest about credit risk management and measurement supported by financial innovations, competition policies, and computational improvements. Additionally, under the Basel II Capital framework, banks were allowed to use internal credit risk models in order to determine their capital requirements. Thus, banks had developed several techniques to analyze firms' financial positions, probability of default, and other credit risk parameters. More recently, the economic and financial crises, and the significant increase in the materialization of credit risk, reinforced the importance of a close monitoring of the firm's financial position and credit risk standards.

This study explores corporate credit default, investigating if some variables underlying liquidity indicators, such as working capital, and turnover contain additional information regarding a firm's financial health and its creditworthiness. Therefore, apart from the standard financial variables applied in the empirical literature, related to profitability, leverage, or firm size, we include variables directly related to firms' activity, such as production cycle, cash holdings, and efficiency in determining the probability of a bank loan default. We also explore the role of firms' tax liabilities. This analysis has in mind that working capital and turnover may have significant

underlying differences related to firms' operational cycle, efficiency, or even the management of inflows and outflows, and consequently potentially different assessments of firms' financial soundness.

In this analysis we combine micro data for Portuguese firms from the Central Balance Sheet Database with information about credit status and banking relationships from the Central Credit Register, both databases available at Banco de Portugal. As these databases are quite exhaustive, the data set allows a high coverage of banks' exposure to the corporate sector. It also allows exploring corporate heterogeneity, analyzing different firms' segments. In the econometric analysis we apply a logit model for panel data to assess the relevance of firm's characteristics in its probability of default.

According to the results obtained, the breakdown of firms' working capital and turnover improves the analysis of the probability of default. In particular, the indicators related to firm's activity, such as management of inflows and outflows contain additional information regarding firms' financial positions. The results also highlight the relevance of tax liabilities as an indicator of firms' financial fragilities. Thus, these results suggest the value of a close analysis of a firm's activity as an indication of that firm's financial soundness. Moreover, the results suggest a relationship between tax liabilities and a firm's financial fragility, and consequently this dimension should be included in corporate credit risk analysis.

The remainder of this Chapter is organized as follows: Section 1.2 briefly reviews related literature. Section 1.3 presents a description of the data sources and variables under analysis, as well as some descriptive statistics. Section 1.4 presents the econometric approach adopted. Section 1.5 shows the main econometric results, including the analysis of different corporate segments. Section 1.6 includes some robustness tests. Finally, Section 1.7 presents the main conclusions.

1.2 Related literature

Credit risk is related to the possibility of losses due to changes in the credit quality of the counterparts. Much of the literature on corporate credit risk is related to modeling default events, *i.e.* the failure of a firm to meet the terms agreed in credit contracts. Several quantitative models have emerged in this field.

For firms with publicly traded equity or debt, there are the structural or reduced-form models (see Bielecki & Rutkowski (2002)), depending on the information available. Structural models focus on modeling and pricing credit risk of a firm, in which the firm's asset value assumes a crucial role. These models intend to link the credit events, mainly default situations, to the firm's fundamentals. One of the most popular structural models was developed by Merton (1974). According to Merton's model, a firm's equity value is similar to a call option on the value of its assets, where the strike price is the value of the liabilities. In this framework, default occurs when the firm's asset value falls below the value of its liabilities at maturity date.[1] In line with this model, the credit risk of a firm is essentially driven by the dynamics of the asset value and the respective volatility, taking the value of liabilities as given: the greater the value of the firm, and the less its volatility, the lower the probability of a default event.[2] Several studies have explored this model in determining the probability of default for firms. Moody's - KMV model (Moody's (2004)) is one of the most well known. In turn, under reduced form models (suggested in Jarrow

[1]Note that default event is different from bankruptcy. The latter occurs when the firm is liquidated, *i.e.* it is not able to pay own debts. Bankruptcy is based on a legal definition, and so it is a country-specific concept. Default corresponds to a delay in payments according to the pre-defined terms of credit contracts.

[2]The number of standard deviations that a firm's asset value is away from the default point is defined as distance-to-default. Generally, distance-to-default (DD) is the distance between the firm's asset value in one year $E(V_1)$ and the default point (DPT), based on liabilities' structure maturity, expressed in standard deviations of assets' value (assets' volatility):

$DD = (E(V_1) - DTP)/\sigma_{V_1}$

& Turnbull (1992)), the firm's assets value is not modeled and default events are specified exploring some exogenous process.

Despite the attractiveness of these approaches, and the forward looking perspective that market data incorporates, their implementation is limited by the availability of these data. This is an important issue for several European countries, given that the fraction of listed firms or firms with access to debt markets is quite limited. This fraction is even lower for firms that are traded on a regular basis.[3]

Much of the empirical literature relies on more traditional approaches in order to explore the firm's idiosyncratic risk factors and its creditworthiness. In particular, these studies intend to identify the contribution of firms' financial indicators, mainly based on accounting data, and other general firms' characteristics in determining the probability of a default event. Even though the limitations of accounting data (lack of theoretical support, and the backward perspective), some studies, such as Demirovic & Thomas (2007) and Agarwal & Taffler (2008), found evidence that accounting-ratio approaches are also meaningful in credit risk analysis. Demirovic & Thomas (2007) found evidence that accounting variables contain incremental information when added to an approach with market measures. Agarwal & Taffler (2008) found that traditional models are robust and not inferior to market-based models.[4]

[3]Given the constraints related with market data availability, some analyses go back to market information of comparable firms in order to estimate the market assets value of non-listed firms. The market multiples approach allows to determine a firm's value based on the market's assessment of its peers. This approach is based on public financial information of peers, on specialist analysis, and/or information disclosed to the market. Thus, this approach allows estimating the market value of a non-listed firm based on market's assessment of other firms in the same business sector. However, multiples are influenced by the conditions observed in the financial markets and by the characteristics of firms included in the set of peers. Therefore, the criteria underlying the definition of this set of firms is crucial. It should be selected in order to minimize the difference between firms, taking into account operational activity, risk, economic and financial environment, as well as the legal and competition framework. The disadvantage of the market multiples is also related to its dependence on the cyclical evolution of the capital markets, as well as the general environment. Across the several multiples approaches, the EBITDA multiple is often used, since it minimizes differences between firms. In particular, it avoids differences in the fiscal system, amortization policies, and capital structure.

[4]Actually, Agarwal & Taffler (2008) argued that despite some limitations, there are also some

The empirical research explores corporate credit risk in different perspectives, using different data and methodologies. The seminal empirical papers analyzing the relevance of financial variables in identifying firms' default go back to the 1960s with Beaver (1966) and Altman (1968). Beaver (1966) found that several ratios present significant differences between failed and viable firms. He also observed that those differences increased as the time to a failure decreased. Using a set of some financial variables, Altman developed a weighted linear indicator to identify distress and non-distress firms. The Altman's indicator, known as *Z-score*, has persisted as a benchmark until the present day in corporate credit risk literature.[5]

Over the following decades, the empirical literature on corporate default was extensive. Despite a lack of consensus in the literature regarding which firms' characteristics should be considered as more important in modeling default events, a pattern among the variable selection suggests the importance of some categories of indicators. Looking at financial indicators, measures related to profitability, leverage, and liquidity are within those typically found as relevant in determining firms' default. Other firms' characteristics, such as size, age, and business sector were also highlighted in empirical research (see, for instance, Bunn & Redwood (2003), Benito et al. (2004), Carling et al. (2007), Lacerda & Moro (2008), and Bonfim (2009)).

As a complement to firm-specific information, the macroeconomic and financial environment has also been included in the credit risk empirical literature. This was motivated by the fact that average default frequency and firm default probabilities present some co-movements with macroeconomic and financial variables. This sug-

facts that justify that the account ratios should also be assessed in credit risk perspective. The authors argued that corporate failure events are not a sudden episode. In general, failures occur after some years with adverse performances, with impact on firms' accounting financial statements. They also highlighted that several loan covenants (in credit contracts) are defined based on accounting indicators.

[5]The variables included in Altman's *Z-score* index were: working capital/total assets, retained earnings/total assets, ebitda/total assets, market-value-equity/book value total liabilities, and sales/total assets.

gests that aggregate shocks can be a driver of corporate default.[6] Actually, Duffie et al. (2007), Pesaran et al. (2006), Jacobson et al. (2013), and Bonfim (2009), for instance, show that (in addition to the firm's idiosyncratic characteristics) macroeconomic environment variables improve the prediction of the probability of default models.

Some avenues of credit risk literature also explored the relevance of trade credit in corporate default, as well as bank lending relationships. Actually, trade credit plays an important role as external funding source for firms in several countries. One of the main questions is related to a firm's choice between bank and trade credit, as trade credit is perceived as more expensive (based on implicit interest rate). The literature presents several reasons for their coexistence. Some arguments are related to financial factors, while others are related to the non-financial role of trade credit, such as transaction costs, price discrimination, warranty of product quality, or customer relationships, (*e.g.* Petersen & Rajan (1997)). On the financial perspective, many studies emphasize that firms use trade credit because there are bank credit constraints (*e.g.* Petersen & Rajan (1994), Nilsen (2002), and Cuñat (2007)).[7] These studies support the hypothesis that firms use other available forms of credit before trade credit as a funding source. In this context, non-bank private markets complement banks and public funding sources (financial markets) mainly for lower credit quality firms. Nevertheless, according to Biais & Gollier (1997) and Burkart & Ellingsen (2004), for instance, trade and bank credits can be either complements or substitutes. This argument is based on the fact that the suppliers may have a comparative advantage over banks in collecting information on firms, in assessing their creditworthiness, and in monitoring their actions. Giannetti et al.

[6]See, for instance, the initial analysis presented in Bonfim (2009), or the Financial Stability Reviews of European Central Bank or Banco de Portugal.

[7]For instance, Cuñat (2007), for a panel of UK firms, found that trade credit is used at the margin, when other forms of credit have already been exhausted. The results also suggest that the evolution of trade credit is related to the length of the commercial relationships, and that trade credit seems to be more usual when firms have lower levels of liquidity.

(2011) also supports the complementarity between trade and bank credit.

According to the bank lending relationship literature, the firm-bank relationship is crucial in mitigating asymmetric information. This is especially important for smaller and younger firms, for which information is scarcer. A lending relationship may help to overcome this problem given that banks obtain firms' private information through repeated interactions (Diamond (1984)). Thus, the literature suggests that firms that borrow from a small number of banks, or even concentrate a substantial part of their funding in a single relationship, tend to record lower financing constraints and obtain more favorable credit conditions.[8,9] However, a non-negligible fraction of firms has more than a single lending relationship. The stability and efficiency of lending relationships depend on several factors, both in banks' and firms' perspectives. For instance, there are hold-up issues (information rents), market competition pressure, and banks' portfolio diversification incentives (e.g. Sharpe (1990), Rajan (1992), Detragiache et al. (2000), Von Thadden (2004), and Carletti et al. (2007)). The link between the number of banking relationships and a firm's credit quality has also been explored, but the arguments are mixed. Some authors argue that a single relationship may be driven by potential refusal of credit from other banks. Hence, it may be a negative signal to the market, making exclusive bank relationships undesirable. Other authors report evidence that firms with lower credit quality tend to establish multiple lending relationships (*e.g.* Detragiache et al. (2000), Degryse & Ongena (2001), Farinha & Santos (2002), and Fok et al. (2004)).

Looking at the Portuguese corporate sector, there are also some studies exploring

[8]For instance, an increase in the number of lending relationships decreases the amount of credit (Petersen & Rajan (1994), Cole (1998), and Harhoff & Korting (1998)), while longer relationships increase the availability of credit (Petersen & Rajan (1994), Harhoff & Korting (1998)), and contribute to a decrease in collateral requirements (Harhoff & Korting (1998), and Berger & Udell (1995)). Looking at interest rates, the empirical evidence is mixed (*e.g.* Berger & Udell (1995), Petersen & Rajan (1994), and Bonfim et al. (2008)).

[9]Boot (2000) and Ongena & Smith (1998) review the first wave of the literature on banking relationships, while Berger & Udell (2006) discuss the role of banking relationships in a more recent financial framework, given the transformation observed in the financial industry since the early 2000s.

credit risk. Antunes et al. (2005) estimated the probability of default of non-financial corporations using bank loan data, firms' business sector, and macroeconomic variables. In turn, Soares (2006) and Bonfim (2009) based their analyses on micro data. Soares (2006) intended to estimate a synthetic indicator to identify potential distress events. In this study, based on discriminant analysis, the financial ratios selected were related to leverage, funding structure, liquidity and profitability. According to Bonfim (2009), profitability, solvency, liquidity, investment path, and sales were relevant in determining the probability of default. Moreover, as mentioned above, the inclusion of macroeconomic developments improved the econometric results. Lacerda & Moro (2008) analyzed Portuguese firms' default exploring three alternative techniques, namely logistic regressions, discriminant analysis and support vector machine (SVM). They found that SVM was very good in capturing non-monotonic dependence of the probability of default from some firms' characteristics. However, they also found that the three methods identified several important common variables. Indicators related to funding costs, liquidity, activity, leverage, as well as interest over debt ratio, credit lines, accounts payable, and size played a role as predictors of a firm's default. Variables related to the number of banking relationships and the length of time of employees in the firm also revealed to be important in the analysis. Bhimani et al. (2010) also found the importance for some of the above-mentioned indicators, and highlighted the relevance of non-financial variables in determining a firm's default. Finally, Antunes & Martinho (2012) developed a scoring model for Portuguese firms. The variables selected were related to profitability, turnover, leverage and liquidity. They also emphasized the heterogeneity across firms' business sectors regarding credit risk and bank credit default events.

1.3 Data and variables

1.3.1 Data sources

The empirical analysis performed in this study is based on the information of the Central Balance Sheet Database (CB) and the Central Credit Register (CRC), both available at Banco de Portugal.[10]

The CB contains financial information, based on balance sheet and profit and losses account, as well as other firm characteristics, such as the economic activity sector, and the date of set up. Since 2006, instead of a voluntary survey, the annual CB is based on Simplified Corporate Information (*Informação Empresarial Simplificada* - IES), which is a joint project of Bank de Portugal, Ministry of Justice, Ministry of Finance, and the Portuguese Institute of Statistics. IES also contains financial and non-financial data, as previously reported in the survey approach, but it covers virtually the entire Portuguese corporate sector.[11]

The CRC contains information regarding the credit granted by financial institutions operating in Portugal. This database, which is mandatory and reported on a monthly basis to Banco de Portugal, contains the total outstanding amount of loans, unused credit lines, and information for credit overdue, among other components. Thus, due to the low threshold required for the report (loans above 50 euros), CRC contains nearly all the credit exposures of the banking system to Portuguese firms.[12]

[10] Occasionally, *Quadros de Pessoal* database (QP) was also used to complement some information regarding firm's employees.

[11] IES is an electronic submission of information of accounting, fiscal and statistical nature that firms have usually to submit to several Portuguese authorities, namely Ministry of Justice, Ministry of Finance, Statistics of Portugal, and Banco de Portugal. Thus, instead of firms submitting nearly the same information to the different entities, at different moments of time, and in different reports, as occurred before 2006, with the IES system they do it once. As all firms are expected to submit the report, IES allows a high coverage of the Portuguese corporate sector by the Central Balance Sheet Database of Banco de Portugal.

[12] For further details on the CRC and IES databases, see Booklet Nr.5 of Banco de Portugal (Banco de Portugal (2011*a*)), and Supplement of Statistical Bulletin (Banco de Portugal (2008)),

In order to explore IES information, which has broad coverage of the Portuguese corporate sector and simultaneously avoids the possible sample bias that voluntary surveys may induce (especially toward firms with better financial position), the period under analysis is limited to 2006 - 2009. The sample period ends in 2009, given that some variables explored in the current analysis (and discussed in following sections in this Chapter), were discontinued from 2010 on.[13]

Moreover, some selection criteria were imposed. First, the financial sector and public administrations were excluded, as well as observations with misreported data for total assets, business volume, number of employees, and age. Furthermore, firms with fewer than five employees were also ruled out. Then, observations with extreme values for some variables included in the analysis were excluded (1 per cent of the tails of the respective distributions), which allows controlling for extreme outliers.

After these steps, given the purposes of this study, we restricted the sample to firms that are simultaneously on the two databases, *i.e.* on both IES and CRC. In other words, we restricted the sample to firms with relationships with the financial system. Combining all the criteria, the data set comprises around 230,700 observations.

1.3.2 Determinants of firm default

This study analyzes if some components underlying working capital and turnover contain relevant information for determining the probability of default of a firm. Simultaneously, firm's business risk is included in the analysis, in line with the struc-

respectively.

[13]As mentioned above, IES started in 2006, but for the main element in financial statements, information for the previous year was also required. Given this fact, data for 2005 were also collected to compute some indicators for 2006. In turn, in 2010 there were changes in IES data. In parallel with the introduction of new accounting rules, there were also some changes in the IES templates, creating a discontinuity in some variables.

tural models, in which volatility is one of the key elements. Other firm characteristics and macroeconomic developments were also controlled for, given their relevance in determining a default event, as discussed in the literature section. Moreover, following the banking relationship literature, the firm's relationships with the banking system were also included in the analysis. In general, we have:

$$\begin{aligned}\text{Prob}(Default_{i,t}) = f(&working\ capital\ and\ turnover\ components_{i,t};\\ &other\ characteristics_{i,t};\ banking\ relationships_{i,t};\\ &business\ risk_i;\ macroeconomic\ environment_t)\end{aligned} \tag{1.1}$$

where the left-hand side is the probability of default of firm i at the period t. The right-hand side includes a set of several variables that may be underlying a firm's default.

A default event is defined when a firm has bank credit overdue for a period longer than three consecutive months (flagged in the CRC), evaluated at the end of the year, and greater than 500 euros.[14]

Looking at firm characteristics, working capital (WORKING CAPITAL), defined as the ratio of current assets net of current liabilities over total assets, is a relevant indicator in the financial analysis of a firm, given that it represents operating liquidity and liabilities commitments in the short-run. Debt holders are usually concerned with a firm's liquidity, since they are concerned about the payment of the initial loan, but also with the ongoing payments. Earlier studies identified liquidity as a relevant variable in determining default events, with a negative relationship (*e.g.*

[14]Note that a default event corresponds to a delay in the payment of the installment and/or the reimbursement of the principal at the debt maturity. It does not necessarily imply a bankruptcy event. Moreover, it should be noted that the imposition of three consecutive months may be a conservative criterion, as financial institutions should report overdue events after the 90 days. This conservative rule implies that the default events may be underestimated in the data set, but it avoids some potential misreporting records. The 500 euros threshold is also intended to exclude misleading events.

Altman (1968) and Bhimani et al. (2010)). However, working capital requires a careful analysis. For instance, an increase in this indicator may reflect firms' decisions that might help to minimize stock-out events or even stimulate sales. However, an increase in this ratio may also reflect a build up of inventories (and money is tied up in inventories) or credit to customers. In these cases, the firm cannot use it to pay off any of its commitments. Therefore, an increase in working capital may have underlying negative developments in the firm's financial health and increase its vulnerabilities. The turnover variable (TURNOVER), defined as sales over total assets, is related to the firm's efficiency, as it indicates how a firm uses assets in its business. A high volume of sales into total assets means that the firm takes advantage of its investments.

In this study, working capital and turnover indicators are decomposed into some underlying components related to cash holdings, investment turnover, and activity indicators, namely accounts receivable, accounts payable, and inventories, in order to identify the firm's operational fragilities that may induce default. Additionally, we also include in the analysis the share of tax liabilities. Bernhardsen & Larsen (2007) explored trade accounts payable and unpaid taxes in the extended version of a model to analyze banks' credit risk exposures to the corporate sector, in addition to other financial ratios, age, size, and industry.

Looking at the other variables included in the analysis (equation 1.1), the component "other firm characteristics" includes accounting and non-accounting indicators, in line with the empirical finding discussed above. Concerning accounting data, the analysis includes measures related to leverage (LEVERAGE), sales growth (SALES GROWTH), interest coverage by earning before interest, depreciation, and amortization (ebitda) (INTEREST COVERAGE), as well as the coverage of total liabilities (DEBT COVERAGE). These coverage indicators allow analyzing firms' ability to repay

capital and interest through the ongoing operational income.[15] Note that according to the ebitda multiple approach, a standard procedure adopted in the valuation of firms, the coverage of firms' liabilities by ebitda can be seen as a proxy for the coverage of debt by the firm's market value, for firms belonging to the same business sector.[16] The set of variables also includes firm size, based on the natural logarithm of real total assets (SIZE). Concerning non-accounting data, age (AGE) and changes in the number of total employees (CHANGE EMPLOYEES) were also included. Furthermore, business sectors were controlled for, given that financial ratios should be assessed in conjunction with the nature of the firm and the market in which the firm operates. Moreover, the literature also highlights that there are relevant differences in default by business sectors.

In turn, for business risk the proxy was the volatility of cashflow over total assets (SD CASHFLOW). Banking relationships comprise the number of total relationships, defined at the banking group level and taking into account the weight of each banking group in the firm's total bank debt (BANKING RELATIONSHIPS). The analysis also includes the absolute change in the number of banking relationships over the year (CHANGE BANK RELATIONSHIP), as well as the availability of unused credit lines (CREDIT LINE).

Finally, in order to control for the economic and financial environment, time dummies were included in the specification, or alternatively the GDP year-on-year growth rate (GDP) and the average interest rate applied on loans to non-financial corporations (INT RATE). Table I.1 in the Appendices Section of this Chapter summarizes the definition of each variable. Table I.2 presents the correlation matrix

[15] In order to avoid potential collinearity in the regressors, a direct measure of profitability was not included in the specifications. Indeed, in the correlation matrix included in the Appendices Section of this Chapter, we can observe that DEBT COVERAGE and INTEREST COVERAGE are highly correlated with the profitability indicator (PROFITABILITY), measured by operational returns over total assets.

[16] Some considerations about the ebitda multiple approach are presented in the footnote 3, in Section 1.2 Related Literature.

between the variables.

1.3.3 Descriptive statistics

This sub-section presents some summary statistics of the data set used in this study, including a breakdown by default and non-default firms and by firms' size (based on the recommendation of the European Commission).[17] In Table 1.1 we see that micro and small firms represent most of the data set (around 90 per cent). In turn, in the sample period, the fraction of default events is small in the total sample, as well as in each firm's dimension class. Nonetheless, there is a gradual increase of this fraction, in general, over the period under analysis, which is in line with macroeconomic and financial developments, and supports the cyclicality of default events.

Table 1.1: Sample summary statistics

	Total		Micro		Small		Medium		Large	
Year	# Obs.	% default	# Obs.	% default	# Obs.	% default	# Obs.	% default	# Obs.	% default
2006	58,540	1.9	27,700	1.9	25,782	1.8	4,357	2.2	701	2.0
2007	59,627	2.1	27,923	2.0	26,472	2.1	4,489	2.3	743	3.9
2008	58,209	2.5	27,382	2.6	25,793	2.5	4,327	2.1	707	1.4
2009	54,354	3.0	25,629	2.9	24,068	3.0	4,014	3.1	643	3.0
Average	57,683	2.4	27,159	2.3	25,529	2.4	4,297	2.4	699	2.6
Total	230,730		108,634		102,115		17,187		2,794	

The differences between default and non-default firms are illustrated in Table 1.2. This table has some descriptive statistics of firm characteristics included in the two groups of firms. It is noteworthy that the sample mean of firm characteristics for the

[17] According to the European Commission Recommendation of 6 May 2003 (2003/361/EC), micro firms are defined as those with fewer than 10 employees and less than 2 million euro of business volume or total assets; small firms are those with fewer than 50 employees and less than 10 million euro of business volume or total assets; medium firms are those with fewer than 250 employees and a business volume below 50 million euros or whose total assets are lower than 43 million euros. All remaining firms are defined as large firms.

two groups are statistically different according to the Welch test.[18] Thus, firms that do not fulfill their credit commitments seem to present some particular features.

Default firms reveal lower levels of working capital and turnover in comparison to non-default firms. They also show lower coverage of liabilities and interest by ebitda, sales growth and employees changes. Moreover, these firms show lower levels of cashflows and higher volatility. In turn, default firms have significantly higher leverage ratios. Note that the leverage ratio of the percentile 25 of default firms is close to the percentile 50 figure of non-default firms. Looking at bank lending relationships variables, default firms show a lower concentration of total debt, which means that these firms tend to establish more banking relationships than non-default firms (or at least, tend to have greater dispersion of credit among their lenders).

Looking at some components underlying working capital and turnover indicators, default firms have higher levels for the activity indicators, *i.e.* for accounts payable, accounts receivable, and inventories indicators. Default firms show lower cash reserves, and investment turnover. These firms also present a significantly higher proportion of tax liabilities over total assets.

Table 1.3 has the mean and median figures of some variables by firm size, given the potential difference of some of these characteristics by firm dimension, in line with diversified activity and information opaqueness of firms.

A positive relationship is broadly observed for working capital, while there is no significant variation for assets turnover. Concerning activity indicators, there is a negative relationship for inventories and accounts payable, while for accounts receivable the relationship is not monotonic. Investment turnover seems to present a U-shape relationship. The same path applies, in general, for the coverage of interest

[18]The Welch test compares the mean figures between two groups, taking into account possible differences in the variance of these groups.

Table 1.2: Descriptive statistics: Non-default *versus* default firms

Panel A - Non-default firms

	mean	sd	p10	p25	p50	p75	p90
WORKING CAPITAL	0.19	0.42	-0.32	-0.04	0.19	0.45	0.71
TURNOVER	1.42	0.99	0.50	0.78	1.18	1.77	2.59
ACCOUNTS PAYABLE	0.29	0.27	0.03	0.10	0.22	0.38	0.60
ACCOUNTS RECEIVABLE	0.23	0.23	0.00	0.03	0.18	0.34	0.51
INVENTORIES	0.36	0.65	0.00	0.03	0.14	0.38	0.88
CASH & EQUIVALENTS	0.28	0.60	0.01	0.02	0.08	0.26	0.69
INVESTMENT TURNOVER	16.46	42.28	1.19	2.44	5.46	13.31	32.99
TAX LIABILITIES	0.05	0.07	0.01	0.01	0.03	0.06	0.11
SOCIAL SEC. LIABILITIES	0.00	0.02	0.00	0.00	0.00	0.00	0.00
DEBT COVERAGE	0.20	0.32	-0.03	0.06	0.13	0.26	0.50
INTEREST COVERAGE	105.9	827	-1.1	2.2	5.7	17.2	60.8
LEVERAGE	0.74	0.27	0.40	0.58	0.75	0.88	0.98
SALES GROWTH	0.01	0.27	-0.28	-0.12	0.00	0.12	0.30
CASHFLOW RATIO	0.07	0.12	-0.03	0.02	0.06	0.12	0.19
SD. CASHFLOW	0.06	0.07	0.01	0.02	0.04	0.08	0.14
CHANGE-EMPLOYEES	0.03	0.19	-0.17	-0.08	0.00	0.10	0.23
BANKING RELATIONSHIPS	0.71	0.27	0.34	0.49	0.72	1.00	1.00
CHANGE_BANK_RELATIONSHIP	0.21	0.84	-1.00	0.00	0.00	1.00	1.00
CREDIT LINE	0.67	0.47	0.00	0.00	1.00	1.00	1.00
SIZE	13.32	1.42	11.64	12.34	13.19	14.14	15.17
AGE	2.48	0.84	1.39	1.95	2.56	3.09	3.47

Panel B - Default firms

	mean	sd	p10	p25	p50	p75	p90
WORKING CAPITAL	0.03	0.45	-0.55	-0.23	0.04	0.30	0.61
TURNOVER	0.86	0.71	0.28	0.44	0.68	1.05	1.59
ACCOUNTS PAYABLE	0.58	0.45	0.08	0.25	0.49	0.80	1.22
ACCOUNTS RECEIVABLE	0.33	0.31	0.00	0.06	0.26	0.49	0.78
INVENTORIES	0.51	0.91	0.00	0.02	0.17	0.56	1.41
CASH & EQUIVALENTS	0.12	0.29	0.00	0.01	0.02	0.09	0.33
INVESTMENT TURNOVER	11.93	37.94	0.63	1.25	2.86	7.64	21.50
TAX LIABILITIES	0.13	0.14	0.01	0.03	0.07	0.18	0.33
SOCIAL SEC. LIABILITIES	0.03	0.06	0.00	0.00	0.00	0.03	0.12
DEBT COVERAGE	0.07	0.20	-0.12	-0.02	0.06	0.13	0.23
INTEREST COVERAGE	25.41	447	-5.78	-0.58	1.91	5.04	14.39
LEVERAGE	0.92	0.28	0.62	0.76	0.88	1.00	1.25
SALES GROWTH	-0.13	0.35	-0.57	-0.33	-0.12	0.05	0.26
CASHFLOW RATIO	0.00	0.14	-0.16	-0.05	0.02	0.06	0.13
SD. CASHFLOW	0.08	0.09	0.01	0.03	0.05	0.10	0.18
CHANGE-EMPLOYEES	-0.05	0.21	-0.29	-0.17	-0.06	0.00	0.20
BANKING RELATIONSHIPS	0.58	0.25	0.28	0.38	0.52	0.80	1.00
CHANGE_BANK_RELATIONSHIP	0.02	0.99	-1.00	0.00	0.00	0.00	1.00
CREDIT LINE	0.60	0.49	0.00	0.00	1.00	1.00	1.00
SIZE	13.60	1.37	12.05	12.68	13.42	14.37	15.43
AGE	2.45	0.78	1.39	1.95	2.48	3.00	3.43

Note: sd stands for standard deviation. p10, p25, p50, p75, and p90 stand for, respectively, the percentiles 10, 25, 50, 75, and 90 of the distribution of each variable.

by ebitda. In turn, a negative relationship is observed between firm size and leverage, tax liabilities, cashflow volatility (even though small), as well as weighted bank relationships. Debt coverage and sales growth show a positive relationship with firm size.

Table 1.3: General statistics description by firm dimension

	Micro		Small		Medium		Large	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
WORKING CAPITAL	0.16	0.17	0.21	0.20	0.22	0.20	0.20	0.18
TURNOVER	1.42	1.16	1.41	1.18	1.39	1.17	1.38	1.19
ACCOUNTS PAYABLE	0.30	0.21	0.30	0.24	0.27	0.23	0.23	0.20
ACCOUNTS RECEIVABLE	0.21	0.15	0.25	0.21	0.24	0.22	0.21	0.19
INVENTORIES	0.42	0.16	0.32	0.13	0.25	0.14	0.21	0.12
CASH & EQUIVALENTS	0.30	0.09	0.26	0.08	0.21	0.05	0.23	0.04
INVESTMENT TURNOVER	18.51	5.68	14.49	5.27	13.48	4.64	18.22	5.03
TAX LIABILITIES	0.06	0.03	0.05	0.03	0.04	0.02	0.03	0.02
LEVERAGE	0.77	0.78	0.72	0.74	0.69	0.71	0.67	0.69
DEBT COVERAGE	0.19	0.12	0.21	0.13	0.23	0.14	0.28	0.16
INTEREST COVERAGE	106.4	5.7	94.9	5.6	122.9	5.2	223.3	6.2
SALES GROWTH	-0.01	-0.01	0.01	0.00	0.02	0.01	0.03	0.02
CASHFLOW RATIO	0.06	0.06	0.07	0.06	0.07	0.06	0.08	0.07
SD CASHFLOW	0.07	0.04	0.06	0.04	0.05	0.03	0.04	0.03
CHANGE-EMPLOYEES	0.00	0.00	0.05	0.00	0.04	0.00	0.04	0.01
BANKING RELATIONSHIPS	0.78	0.89	0.67	0.63	0.52	0.46	0.50	0.42

Note: Firm size is defined according to the European Commission Recommendation of May 2003 (2003/361/EC). Mean and Median figures are based on the distribution of each variable.

1.4 Econometric analysis

1.4.1 Econometric specification

The econometric approach adopted in this study relies on a logit model for panel data. The dependent variable, $d_{i,t}$, is a dummy variable that takes the value one if firm i, in period t, presents a credit default event and zero otherwise. This variable is related to another latent unobserved random variable, $d^*_{i,t}$, which can be defined as:

$$d^*_{i,t} = \alpha + x'_{i,t}\beta + z'_t\delta + \varepsilon_{it}$$

where the error term, $\varepsilon_{i,t}$, conditional on $x_{i,t}$, and z_t, follows a logistic distribution. $x_{i,t}$ is the set of time-varying specific characteristics of firm i, while z_t is time specific variables.

If we have $d_{i,t} = 1$ if $d^*_{i,t} > 0$ and zero otherwise, we obtain:

$$\begin{aligned}
\text{Prob}\left(d_{i,t} = 1 \mid x_{i,t}; z_t\right) &= \text{Prob}\left(d^*_{i,t} > 0 \mid x_{i,t}; z_t\right) \\
&= \text{Prob}\left(\varepsilon_{it} > -(\alpha + x'_{i,t}\beta + z'_t\delta)\right) \\
&= 1 - F\left(-(\alpha + x'_{i,t}\beta + z'_t\delta)\right) \\
&= F\left(\alpha + x'_{i,t}\beta + z'_t\delta\right)
\end{aligned}$$

where, $\text{Prob}\left(d_{i,t} = 1|x_{i,t}; z_t\right)$ is the probability of default of firm i in period t, and $F(.)$ is the cumulative probability function of the error term, $\varepsilon_{i,t}$.

The variable $d^*_{i,t}$ can be seen as a function of the firm's losses, such that if it is greater than zero (or if the losses exceed a given threshold) the firm defaults.

As shown above, the probability of default is defined as a function of the firm's characteristics ($x_{i,t}$), and some factors common to all firms (z_t).

The logit model uses the maximum likelihood methodology and the characteristics of firms that have survived and failed to efficiently determine the optimal weight of each explanatory variable in an index of likelihood of failure, which is then mapped into a probability between 0 and 1. The model estimated was based on unbalanced panel data, with random effects.[19]

1.5 Econometric Results

1.5.1 Do activity indicators and tax liabilities contain relevant information?

The analysis carried out above shows a significant difference between default and non-default firms. In particular, we observe differences regarding operational management. In this Section we intend to corroborate some of these findings through econometric analysis. For this purpose we focus on new episodes of default, *i.e.* we exclude from the data set observations that recorded default events in two consecutive years.[20] The underlying idea of this option is to identity the main characteristics of firms that may justify transaction events, *e.g.* transaction from a regular position to a default event.

We begin by presenting the results for a baseline specification that includes work-

[19]Note that it would not be possible to adopt a firm fixed-effect specification, as some variables under analysis are constant at the firm level. Moreover, this approach would collapse the data set to firms that changed their position in the sample period, excluding from the analysis firms that did not record default events. It is important to include these firms in the analysis in order to observe their characteristics, and so the main patterns of firms that default and those that do not.

[20]This demanded the exclusion of around of 1,500 observations.

ing capital and turnover in the set of explanatory variables. The results are presented in Models 1 and 2 of Table 1.4. For each model, the first column presents the estimated coefficient, while the second column shows the average marginal effects.

We observe that WORKING CAPITAL is statistically significant with a negative coefficient, meaning that firms with higher liquidity tend to present lower probabilities of default. TURNOVER also presents a negative and statistically significant coefficient. Thus, firms with higher operational efficiency have lower default probabilities.

Looking at the other firm characteristics included in the analysis, LEVERAGE shows a positive coefficient, in line with the results reported in the literature (*e.g.* Bonfim (2009), Bhimani et al. (2010), Bunn & Redwood (2003), and Benito et al. (2004)). This suggests that firms whose assets are highly financed by external funding sources have a higher probability of default. This indicates that these firms are more vulnerable, *i.e.* they have lower ability to overcome a negative shock, such as lower profits (or even losses). DEBT COVERAGE shows a negative and statistically significant relationship with default probability, while INTEREST COVERAGE is not statistically significant. These results suggest that the higher the ability of a firm to generate funds internally, *ceteris paribus*, the probability of default is lower.[21] A negative coefficient was found for SALES GROWTH, which seeks to capture corporate potential growth.[22] CHANGE EMPLOYEES, which may be more deeply related

[21] Lacerda & Moro (2008) found some evidence supporting a non-monotonic effect for the interest coverage variable. However, the results of the specifications with dummy variables based on the quartiles of the interest coverage's distribution do not support this fact. We found a monotonic impact, *i.e.* the probability of default decreases as interest coverage ratio increases. Additionally, due to the low coefficients obtained, and the sample distribution, namely the tails' levels, we redefined the interest coverage variable, winsorizing the observations below/above the percentile 10/90 at these figures. The magnitude of the coefficient obtained for this variable increased, as expected. However, the conclusions of the analysis continued to hold. Given these findings, in the remaining analysis in this Chapter, we preserve the initial definition of the interest coverage variable.

[22] As mentioned, sales growth is related with a firm's growth opportunities. However, high growth rates may reflect excessive risk taking. This argument suggests that strong sales growth rates can be positively related with firms distress. However, the analysis of the impact of different percentiles of the sales growth distribution does not suggest this situation, *i.e.* we find a monotonic

with a firm's growth, shows a similar relationship. These results suggest that firms with higher growth opportunities have lower probability of default.[23] AGE shows a negative and statistically significant coefficient, which means that younger firms have higher probability of default. Corporate size, measured by real total assets, shows a positive and statistically significant coefficient. As larger firms are typically perceived with lower risk, this result is somewhat counterintuitive.[24] However, some studies also found a positive relationship between default and firm size (*e.g.* Bonfim (2009), Bhimani et al. (2010), and Benito et al. (2004)).

As far as bank lending relationships variables are concerned, BANKING RELATIONSHIPS have a negative coefficient, which suggests that firms with a higher concentration of bank debt also present lower default probability. These findings are in line with empirical studies that argue that firms with higher credit quality tend to establish fewer lending relationships or, at least, preserve a main relationship, as discussed in Farinha & Santos (2002). However, regarding the dynamics of the total number of lending relationships in each year (CHANGE BANK REL), the estimated coefficient is negative. Thus, firms that increase the number of relationships tend to show lower probability of default. It should be mentioned that the two results are not contradictory. A firm may increase the number of banking relationships without major changes in the importance of its main lenders (and then without sizable effect on the concentration index). Firms with unused credit lines (CREDIT LINES) tend to present lower default probabilities. This result suggests that firms have available funds to overcome unfavorable events (that could lead to default). However, the bank lending relationship variables may be related to a firm's creditworthiness, in the sense that it is expected that banks provide credit (or credit lines) to firms that

impact of sales growth on default probability.

[23]It should be noted that even though sales growth and employees changes may both be related to firm's growth opportunities, the correlation between these variables is not high, as can be seen in the correlation matrix presented in the Appendices Section of this Chapter.

[24]AGE may also be capturing part of the firm's credit quality, and its estimates are in line with *a priori* expectations, *i.e.* it shows a negative relationship with a firm's probability of default.

are assessed as "good credit quality" firms. This potential relationship is addressed in the robustness section of this Chapter.

The business risk, measured by the volatility of cashflow over total assets, shows a positive and statistically significant coefficient. Firms whose cash flows are more volatile, as expected, have higher probabilities of default.

Following the literature that highlights the relevance of global developments, time dummies were also included (Model 1). These variables are all statistically significant and jointly relevant, supporting the contribution of global factors in determining default events. According to these variables, the progressive deterioration in the macroeconomic and financial environment observed in the sample period had a negative impact on default probability. Therefore, common factors related to the global conditions affect the probability of default in addition to the firm's idiosyncratic components. If we try to disentangle the time dummies in some economic drivers, despite the very short period under analysis, we find that the probability of default decreases with the GDP growth but increases with the average interest rate applied on bank credit granted to non-financial corporations (Model 2).[25]

Finally, as mentioned above, all the specifications include business sector dummies, given the structural differences between economic activity sectors. For simplicity, the coefficients of these variables are not presented in the tables. Even though they were not all individually statistically significant, the relevance of their inclusion in the econometric regressions was confirmed by the statistical tests.[26] This result is in line with the findings highlighted in Antunes & Martinho (2012), namely the

[25]The hypothesis of equality of GDP growth and average interest rate coefficients was rejected by statistical tests.

[26]Note that the objective of the current study is to identify the relevance of some firm characteristics in determining the probability of default. The goal was not to estimate the probability of default firm by firm. If this were the case, and given the relevance of business sectors in determining firm's specific features, it would be relevant, for instance, to perform the analysis sector by sector in order to obtain specific coefficients for each variable in each business sector.

heterogeneity across business sectors regarding credit quality.

Models 3 and 4 of Table 1.5 present the results of the specifications in which working capital and turnover are replaced by the variables related with cash reserves, accounts receivable, accounts payable, inventories, investment turnover, and tax liabilities.

The activity indicators, namely accounts payable, accounts receivable, and inventories, have positive and statistically significant coefficients. These results suggest that firms that take longer to repay their suppliers, firms that wait longer to be paid by their customers, and firms that build up inventories for longer periods present higher probabilities of default. In turn, firms with more cash reserves present lower probability of default. The result is in line with the empirical literature on credit default (such as Benito et al. (2004), and Lacerda & Moro (2008)).[27] Investment turnover also presents a negative and statistically significant coefficient. Finally, the share of tax liabilities has a positive and statistically significant coefficient. Therefore, firms with higher shares of those liabilities tend to have higher probabilities of default.

Looking at the average marginal effects, accounts payable and tax liabilities are worthy of mention, with greater impacts on the firm's probability of default (based on a one standard-deviation increase). The results suggest that these variables are closely related to a firm's financial fragility, and consequently firm's creditworthiness.

The remaining variables included as regressors preserve the results discussed above. Table I.3 in the Appendices Section of this Chapter presents the estimated coefficients for all variables (in line with the structure presented in Table 1.4).

[27]Nevertheless, it should be noted that Acharya et al. (2012) argue that an increase in cash holdings may induce higher risk in medium/long run. The authors claim that riskier firms may choose to hold higher cash reserves as a buffer against possible cashflow shortfalls in the future.

Finally, note that the inclusion of the breakdown of working capital and turnover improves the general performance of the regressions in comparison to the baseline models (Models 1 and 2).

Table 1.4: Logit regression - Dependent variable: default

	Model 1		Model 2	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL	-0.3298***	-0.0030***	-0.2999***	-0.0028***
	(-5.68)	(-5.43)	(-5.21)	(-5.00)
TURNOVER	-1.2003***	-0.0111***	-1.1995***	-0.0113***
	(-26.62)	(-15.14)	(-26.70)	(-15.29)
LEVERAGE	1.6575***	0.0153***	1.6717***	0.0157***
	(18.13)	(14.48)	(18.39)	(14.75)
DEBT COVERAGE	-0.5434***	-0.0050***	-0.5478***	-0.0051***
	(-4.04)	(-3.90)	(-4.08)	(-3.94)
INTEREST COVERAGE	0.0000	0.0000	0.0000	0.0000
	(0.38)	(0.38)	(0.39)	(0.39)
SD CASHFLOW	2.1177***	0.0195***	2.1026***	0.0198***
	(8.55)	(7.93)	(8.54)	(7.94)
SALES GROWTH	-0.8297***	-0.0076***	-0.8203***	-0.0077***
	(-12.35)	(-10.43)	(-12.25)	(-10.40)
SIZE	0.0744***	0.0007***	0.0730***	0.0007***
	(4.17)	(4.14)	(4.11)	(4.09)
AGE	-0.3929***	-0.0036***	-0.3961***	-0.0037***
	(-12.67)	(-10.32)	(-12.81)	(-10.46)
CHANGE EMPLOYEES	-1.2849***	-0.0118***	-1.2848***	-0.0121***
	(-11.63)	(-9.75)	(-11.65)	(-9.81)
CREDIT LINES	-0.6156***	-0.0057***	-0.6092***	-0.0057***
	(-13.23)	(-12.69)	(-13.16)	(-12.69)
BANKING RELATIONSHIPS	-2.6191***	-0.0241***	-2.6129***	-0.0245***
	(-28.46)	(-16.39)	(-28.57)	(-16.55)
CHANGE BANK REL	-0.2494***	-0.0023***	-0.2477***	-0.0023***
	(-11.89)	(-9.93)	(-11.81)	(-9.92)
Time dummies	yes			
Macroeconomic controls			yes	
Nr. of Observations	195,329		195,329	
Nr. of Firms	72,649		72,649	
Log likelihood	-14,043.2		-14,054.6	
Pseudo-R^2	0.158		0.158	
Wald Chi2	2,960.2		3,004.9	
Prob > Chi2	0.00		0.00	
Rho	0.24		0.23	
BIC	28,452		28,463	
AIC	28,146		28,167	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a random-effects logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. Z-scores are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects, namely the average marginal effects, assuming as baseline firms with credit lines. In all regressions a constant and business sector dummies were included. The Pseudo-R^2 is a measure of goodness of the fit, being computed as function of the models log-likelihood and of the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If Rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator. BIC stands for the Schwarz's Bayesian Information Criterion, while AIC stands for the Akaike Information Criterion.

Table 1.5: Logit regression - Dependent variable: default - Activity indicators

	Model 1		Model 2		Model 3		Model 4	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL	-0.3298***	-0.0030***	-0.2999***	-0.0028***				
	(-5.68)	(-5.43)	(-5.21)	(-5.00)				
TURNOVER	-1.2003***	-0.0111***	-1.1995***	-0.0113***				
	(-26.62)	(-15.14)	(-26.70)	(-15.29)				
ACCOUNTS PAYABLE					1.7279***	0.0141***	1.7189***	0.0143***
					(28.23)	(18.14)	(28.36)	(18.34)
ACCOUNTS RECEIVABLE					0.3068***	0.0025***	0.3023***	0.0025***
					(3.63)	(3.58)	(3.59)	(3.55)
INVENTORIES					0.0995***	0.0008***	0.0985***	0.0008***
					(4.00)	(3.94)	(3.99)	(3.93)
CASH & EQUIVALENTS					-0.3139***	-0.0026***	-0.3107***	-0.0026***
					(-3.08)	(-3.04)	(-3.06)	(-3.02)
INVESTMENT TURNOVER					-0.0034***	-0.0000***	-0.0034***	-0.0000***
					(-4.61)	(-4.48)	(-4.59)	(-4.46)
TAX LIABILITIES					6.5032***	0.0530***	6.4309***	0.0536***
					(32.61)	(19.80)	(32.75)	(20.00)
Other firm controls	yes		yes		yes		yes	
Sectoral dummies	yes		yes		yes		yes	
Time dummies	yes		no		yes		no	
Macroeconomic controls	no		yes		no		yes	
Nr. of Observations	195,329		195,329		195,329		195,329	
Nr. of Firms	72,649		72,649		72,649		72,649	
Log-likelihood	-14,043.2		-14,054.6		-13,353.2		-13,367.7	
Pseudo-R^2	0.158		0.158		0.200		0.199	
Wald Chi2	2,960.2		3,004.9		2,981.6		3,053.8	
Prob > Chi2	0.00		0.00		0.00		0.00	
Rho	0.24		0.23		0.31		0.30	
BIC	28,452		28,463		27,121		27,137	
AIC	28,146		28,167		26,774		26,801	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a random-effects logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. Z-scores are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects, namely the average marginal effects, assuming as baseline firms with credit lines. In all regressions a constant and business sector dummies were included. The Pseudo-R^2 is a measure of goodness of the fit, being computed as function of the models log-likelihood and of the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If Rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator. BIC stands for the Schwarz's Bayesian Information Criterion, while AIC stands for the Akaike Information Criterion.

1.5.2 Heterogeneity by firm size

Firm size has usually been associated with activity diversification, which may affect the firm's ability to react to idiosyncratic and external shocks. Moreover, it is also related to the available information, and is therefore a proxy for firm's information opaqueness to general economic agents. The uniqueness of the data set used in this study allows a deeper analysis of corporate segments. Against this background we ran the previous specifications partitioning the sample by firm dimension.[28] Table 1.6 presents the main results under this set up (the estimates for all variables are presented in Table I.4 in the Appendices Section).

In general, the results described for the full sample apply for micro and small firms, as illustrated in Panel A, even though with some exceptions. Looking at the specification that includes the decomposition of working capital and turnover (Model 2 for each size cohorts), the activity indicators and tax liabilities are relevant variables in determining the probability of a default event. However, for micro firms accounts receivable and cash reserves are not statistically significant. Comparing the two models, the specifications with the breakdown improve the performance of the baseline specifications.

For firms classified in the medium and large classes, presented in Panel B, some variables lost statistical significance, notably in the case of larger firms. For medium firms, and as far as decomposition of working capital and turnover is concerned, accounts payable and tax liabilities are statistically significant, with positive coefficients. However, unlike the results in the other regressions, accounts receivable shows a negative and statistically significant coefficient. For large firms, fewer variables are statistically significant. Given the specificities of these firms, the results

[28] In this analysis only regressions with the time dummies are presented, since the coefficients of the variables under analysis were very similar to those obtained in specifications with macroeconomic variables (due to short-time dimension of the data set), and the overall performance of the two models did not present sizeable differences.

suggest that accounting data are less informative among large firms. This fact may be underlying the weak statistics properties recorded in these specifications.

The results obtained by the firm's size class confirm the heterogeneity between firms, since the relevance of some variables changes across size cohorts. The information underlying the working capital and turnover indicators, notably the accounts payable and the share of tax liabilities seem to be especially relevant for default probabilities in the segment of smaller firms.

Table 1.6: Logit regression by firm dimension - Dependent variable: default

(Continues)

Panel A - Micro and small firms

	Micro				**Small**			
	Model 1		Model 2		Model 1		Model 2	
	Coef.	Mar.Eff	Coef.	Mar.Eff	Coef.	Mar.Eff	Coef.	Mar.Eff
WORKING CAPITAL	-0.2815***	-0.0026***			-0.4038***	-0.004***		
	(-3.38)	(-3.23)			(-4.64)	(-4.39)		
TURNOVER	-0.9336***	-0.0085***			-1.3256***	-0.0130***		
	(-13.64)	(-8.24)			(-18.33)	(-10.44)		
ACCOUNTS PAYABLE			1.2460***	0.0094***			1.9002***	0.0159***
			(14.17)	(9.89)			(20.24)	(12.94)
ACCOUNTS RECEIVABLE			0.0801	0.0006			0.2598**	0.0022**
			(0.65)	(0.65)			(2.08)	(2.05)
INVENTORIES			0.0671*	0.0005*			0.1102***	0.0009***
			(1.91)	(1.90)			(2.98)	(2.95)
CASH & EQUIVALENTS			-0.1281	-0.0010			-0.9161***	-0.0077***
			(-1.05)	(-1.05)			(-4.60)	(-4.38)
INVESTMENT TURNOVER			-0.0030***	-0.0000***			-0.0040***	-0.0000***
			(-3.08)	(-2.98)			(-3.28)	(-3.17)
TAX LIABILITIES			7.2637***	0.0550***			6.6968***	0.0562***
			(22.49)	(12.34)			(21.82)	(13.83)
Other firm controls	yes		yes		yes		yes	
Sectoral dummies	yes		yes		yes		yes	
Time dummies	yes		yes		yes		yes	
Nr. of Observations	83,562		83,562		92,953		92,953	
Nr. of Firms	38,969		38,969		35,995		35,995	
Log-likelihood	-6,063.7		-5,700.8		-6,624.8		-6,262.2	
Pseudo-R2	0.155		0.206		0.171		0.216	
Wald Chi2	1,248.6		1,161.7		1,374.7		1,330.0	
Prob > Chi2	0.00		0.00		0.00		0.00	
Rho	0.22		0.32		0.23		0.32	
BIC	12,467		11,787		13,593		12,913	
AIC	12,187		11,470		13,310		12,592	

(Table 1.6 Continued)

Panel B - Medium and large firms

	Medium				**Large**			
	Model 1		Model 2		Model 1		Model 2	
	Coef.	Mar.Eff	Coef.	Mar.Eff	Coef.	Mar.Eff	Coef.	Mar.Eff
WORKING CAPITAL	-1.1330***	-0.0116***			0.7042	0.0072		
	(-4.41)	(-3.92)			(1.07)	(0.97)		
TURNOVER	-1.9127***	-0.0196***			-1.0691**	-0.0109*		
	(-8.78)	(-5.66)			(-2.53)	(-1.87)		
ACCOUNTS PAYABLE			3.2408***	0.0307***			2.3131***	0.0219***
			(10.06)	(7.07)			(2.69)	(2.67)
ACCOUNTS RECEIVABLE			-0.7111*	-0.0067*			2.4170**	0.0229
			(-1.82)	(-1.76)			(2.17)	(1.60)
INVENTORIES			-0.1671	-0.0016			0.2420	0.0023
			(-0.99)	(-0.99)			(0.48)	(0.48)
CASH & EQUIVALENTS			-0.7762	-0.0073			0.5171	0.0049
			(-0.99)	(-0.98)			(1.51)	(1.25)
INVESTMENT TURNOVER			-0.0034	-0.0000			-0.0032	-0.0000
			(-0.88)	(-0.86)			(-0.54)	(-0.53)
TAX LIABILITIES			6.5764***	0.0622***			1.7118	0.0162
			(8.16)	(6.23)			(0.35)	(0.35)
Other firm controls	yes		yes		yes		yes	
Sectoral dummies	yes		yes		yes		yes	
Time dummies	yes		yes		yes		yes	
Nr. of Observations	16,204		16,204		2,610		2,610	
Nr. of Firms	5,951		5,951		906		906	
Log-likelihood	-986.0		-946.4		-139.6		-132.5	
Pseudo-R^2	0.258		0.288		0.289		0.325	
Wald Chi2	287.1		270.3		67.4		67.3	
Prob > Chi2	0.00		0.00		0.00		0.00	
Rho	0.21		0.25		0.05		0.10	
BIC	2,263		2,222		515		533	
AIC	2,032		1,961		339		333	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a random-effects logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. Z-scores are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects, namely the average marginal effects, assuming as baseline firms with credit lines. In all regressions a constant and business sector dummies were included. The Pseudo-R^2 is a measure of goodness of the fit, being computed as function of the models log-likelihood and of the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If Rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator. BIC stands for the Schwarz's Bayesian Information Criterion, while AIC stands for the Akaike Information Criterion.

1.5.3 Determinants *versus* predictors of default

The previous results highlight the relevance of activity indicators, investment turnover, cash reserves, and tax liabilities in estimating a firm's probability of default. In this sub-section we re-estimate the specifications presented above, but now including as regressors the firm-specific variables with a lag instead of the contemporaneous ones (with exception of age).

This approach allows us to check if these variables play a role as predictors of default events. In other words, in this specification we investigate if a default event can be influenced by the characteristics of firms at the end of the previous year, $t-1$. This specification may also be useful, as accounting data are obtained with a significant delay. Even though a close banking relationship may minimize the lack of updated information about the firm's performance, some data are not disclosed in a timely way (there is a considerable delay in obtaining accounting data). Moreover, this approach allows us to minimize potential contemporaneous issues in the previous specifications related with a firm's creditworthiness and the respective financial position at the end of each year. The main results of this approach are presented in Table 1.7.

According to the results obtained, the general conclusions already discussed remain valid in terms of statistical significance and the relationship of each variable with the firm's default probability. Nevertheless, there are some exceptions. Looking at the specification with the decomposition of working capital and turnover (Model 2), accounts receivable is not significant. Accounts payable and inventories variables, those activity indicators that can be deeply related to a firm's decisions, show positive and significant coefficients. Therefore, firms with higher levels for these variables tend to have higher probability of default in the following year. Cash reserves and investment turnover continue to present a negative relationship with the

probability of default. In turn, the share of tax liabilities retains a positive and statistically significant coefficient. Thus, firms with higher shares of tax liabilities have a higher probability of default in the following year.

Looking at the impacts of each variable on a firm's probability of default (based on an increase of one standard-deviation), cash reserves and investment turnover reinforced their relevance, in comparison to the previous specifications. This analysis also confirms the importance of accounts payable and the share of tax liabilities on a firm's probability of default. Thus, these variables seem to be relevant indicators of a firm's financial vulnerabilities, and its credit risk.

For the remaining explanatory variables, there are also some differences. In these specifications changes in the number of banking relationships shows a positive and statistically significant coefficient. This result suggests that firms that changed the number of lending relationships have higher probabilities of default in the following year. It thus seems that firms look for other lenders when they face some financial challenges. For simplicity, the estimates for these variables are presented in Table I.5, in the Appendices Section.

It is noteworthy that the variable related to tax liabilities, as it is assessed at the end of each year, could reflect the firm's activity and the regular (and allowed) schedule of tax payments. However, the results of this specification, which takes a lag for the explanatory variables, minimize this argument to some extent. Indeed, the coefficient is positive and statistically significant even with a lag. Moreover, it is worth noticing again that in the econometric analysis we include only new default episodes. Therefore, we do not have in the analysis firms with high shares of tax liabilities and already a bank credit default event.

Tax liabilities

In the previous specifications, tax liabilities over total assets showed to be a relevant indicator in the analysis. Against this background we explore more deeply the role of this component.

We decompose tax liabilities in tax related with Social Security (at overdue) and the remaining taxes (TLSS, and TLOTHER, respectively), having in mind that the failure of commitments in Social Security taxes may be related to financial difficulties for a firm (in particular if employees' contributions are involved). Model 3 in Table 1.7 presents the results under this conjecture.[29]

In this specification the new variables are statistically significant and both show positive coefficients, especially the variable related with Social Security taxes. For the remanning explanatory variables the results described above continue to hold. Thus, firms with higher levels of Social Security taxes over total assets have higher probabilities of default in the following year.

[29]In this specification we used total liabilities instead of short-term, given that the breakdown by debt maturity was not available for the tax components under analysis. However, this procedure should not have any great impact on the analysis, given that a high share of total tax liabilities has short-term maturity.

Table 1.7: Logit regression - Dependent variable: default - with lag regressors

	Model 1		Model 2		Model 3	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL$_{t-1}$	-0.3255***	-0.0046***				
	(-3.84)	(-3.69)				
TURNOVER$_{t-1}$	-1.0266***	-0.0144***				
	(-19.96)	(-11.01)				
ACCOUNTS PAYABLE$_{t-1}$			1.4550***	0.0177***	1.4223***	0.0174***
			(17.89)	(11.76)	(17.46)	(11.72)
ACCOUNTS RECEIVABLE$_{t-1}$			-0.1537	-0.0019	-0.1546	-0.0019
			(-1.32)	(-1.32)	(-1.33)	(-1.32)
INVENTORIES$_{t-1}$			0.1239***	0.0015***	0.1247***	0.0015***
			(3.69)	(3.61)	(3.71)	(3.63)
CASH & EQUIVALENTS$_{t-1}$			-0.5727***	-0.0070***	-0.5219***	-0.0064***
			(-3.91)	(-3.74)	(-3.60)	(-3.47)
INVESTMENT TURNOVER$_{t-1}$			-0.0045***	-0.0001***	-0.0045***	-0.0001***
			(-3.65)	(-3.50)	(-3.66)	(-3.52)
TAX LIABILITIES$_{t-1}$			5.5371***	0.0673***		
			(20.40)	(13.19)		
SOCIAL SEC. LIABILITIES$_{t-1}$					9.6421***	0.1178***
					(16.17)	(11.94)
OTHER TAXES$_{t-1}$					4.5341***	0.0554***
					(14.71)	(11.34)
Other firm controls	yes		yes		yes	
Sectoral dummies	yes		yes		yes	
Time dummies	yes		yes		yes	
Nr. of Observations	119,553		119,553		119,553	
Nr. of Firms	54,003		54,003		54,003	
Log-likelihood	-8,731.5		-8,615.9		-8,587	
Pseudo-R^2	0.129		0.141		0.143	
Wald Chi2	1,666.5		1,645.6		1,675.9	
Prob > Chi2	0.00		0.00		0.00	
Rho	0.05		0.14		0.14	
BIC	17,802		17,618		17,572	
AIC	17,521		17,298		17,243	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a random-effects logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. Z-scores are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects, namely the average marginal effects, assuming as baseline firms with credit lines. In all regressions a constant and business sector dummies were included. The Pseudo-R^2 is a measure of goodness of the fit, being computed as function of the models log-likelihood and of the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If Rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator. BIC stands for the Schwarz's Bayesian Information Criterion, while AIC stands for the Akaike Information Criterion.

1.6 Robustness tests

In this section we performed some robustness tests in order to check how the previous results were influenced by some of the hypotheses adopted.

First, we tested the impact of bank lending relationship variables on the results. Namely we ran an alternative set of regressions in which the direct firm-bank variables were not included as explanatory variables, *i.e.* variables related with credit lines, number of banking relationships and its dynamics over time. As mentioned above, this test is related to the possible link between banks' decisions (reflected in the firm-bank variables) and the firm's financial position. The results obtained for the core variables under analysis remained valid in this framework. Tables I.6 and I.7 in the Appendices Section present the results for this approach.

In another robustness exercise we re-estimate the specifications including the cash conversion cycle (CASH CYCLE), defined as accounts receivable (days) + inventories (days) - accounts payable (days), instead of the three activity indicators individually, *i.e.* accounts receivable, accounts payable, and inventories. According to the estimates this variable was not statistically significant. We also ran some specifications that included general government in net terms (GOVERNMENT NET POSITION), defined as liabilities net of assets position over total assets, *i.e.* taking into account assets and liabilities components simultaneously. The results remained unchanged overall. The results of these robustness tests are presented in Tables I.8 and I.9 in the Appendices Section.

Finally, and as far as the econometric method is concerned, all the regressions presented in previous sections were re-estimated, applying the logit model with standard errors adjusted for heteroscedasticity (robust errors) and clustered at the firm level, instead of the panel data approach. The conclusions discussed before remained

broadly valid. Namely, the effect of the core variables under analysis in this study retained the sign and statistical significance regarding the probability of default. Moreover, the performance of the econometric specifications also improved with the decomposition of working capital and turnover indicators. The results of this econometric approach are presented in Tables I.10 to I.12, in the Appendices Section.

1.7 Final Remarks

In this study we analyzed the relationship of several firm characteristics and the respective credit risk. We sought to identify the potential impact of a firm's operational management and efficiency on its probability of default, controlling for other variables. We performed this analysis on a large data set for firm-bank registers, based on Central Balance Sheet and Central Credit Register databases, which allows for a high coverage of the exposures of the Portuguese banking system to the corporate sector. The sample period is from 2006 to 2009.

Liquidity indicators and turnover are usually identified as relevant variables in the credit risk literature. However, they can reflect different firms' production management and efficiency. According to the results obtained, the decomposition of these variables into variables related directly with cash reserves, activity indicators, investment turnover, and tax liabilities contains additional information regarding firms' financial fragilities. In particular, firms that take longer to repay their suppliers, firms that wait longer to be paid by their customers, and firms whose purchases stay longer as inventories have higher probabilities of default. We also found a positive relationship between a firm's credit risk and the share of tax liabilities. Therefore, based on these results, the operational cycle of a firm and especially the share of tax liabilities are relevant indicators in the analysis of the probability of

bank credit default. The results obtained also broadly highlight the impact of other financial and non-financial firm characteristics on the probability of default, in line with earlier studies on corporate credit risk.

This analysis was based on *ex post* credit risk, *i.e.* situations in which we observe if firms had indeed defaulted or not. This allows us to characterize the financial position and other characteristics of firms that defaulted. Nevertheless, the specifications that include as explanatory variables firm's characteristics with a lag period confirmed the relevance of some firm's characteristics on its probability of default. The variables related to accounts payable and tax liabilities should be highlighted. Furthermore, the breakdown of tax liabilities allowed us to verify that Social Security taxes also seem to be a relevant indicator related with firms' financial fragility.

Broadly, the results suggest that the firm's operational cycle is an important component related to corporate financial health. Moreover, the results stress the relationship between tax liabilities measures and financial soundness/vulnerability of firms. Therefore, based on these findings, the analysis of corporate credit risk should also take into account these indicators.

Moreover, the analysis and results presented in this Chapter raise several questions in corporate finance and credit risk. For instance, how do firms decide on their default events? In which lenders do firms default more often or at first stage? Based on the "pecking order" theory, which establishes a hierarchy in a firm's funding sources (Myers (1984)), can we talk about a kind of "pecking order" in default? The relevance of these questions for credit risk assessment, and also for policy decisions (with a focus on the corporate sector), suggests that these topics should be on the agenda for further work, even though there may be considerable constraints, as the empirical research of these questions is quite data demanding.

Appendices

Table I.1: Variables definition

Variable	Definition
Dependent variable	
DEFAULT	Dummy variable that takes the value 1 if the firm has payments in delay at least longer than 3 months in bank credit
Firm's characteristics	
WORKING CAPITAL	Current assets net of short-term liabilities over total assets
TURNOVER	Sales over total assets
DEBT COVERAGE	Earning before interest, depreciation, and amortization over total debt
INTEREST COVERAGE	Earning before interests, depreciation, and amortization over interest paid
LEVERAGE	Total debt over total assets
SD CASHFLOW	Standard deviation of cashflow over total assets
SALES GROWTH	Sales growth defined as the difference of the natural logarithm of real sales
SIZE	Natural logarithm of real total assets
AGE	Natural logarithm of (1 + age in years)
CHANGE_EMPLOYEES	Change of the number of employees in the year
CASH AND EQUIVALENTS	Cash and equivalents over total debt
ACCOUNTS PAYABLE	Total trade credit over (purchases of goods for resale, raw materials, secondary and consumable supplies & external services)
ACCOUNTS RECEIVABLE	Total trade credits to customers over sales
INVENTORIES	Inventories over cost of goods sold
INVESTMENT TURNOVER	Sales over investment
TAX LIABILITIES	Short-term tax liabilities over total assets
SOCIAL SECURITY TAXES	Social security liabilities (overdue) over total assets
OTHER TAXES	Other taxes rather Social security liabilities (overdue) over total assets
BUSINESS SECTORS	Dummy variables for business sectors (13 sectors)
Banking relationships	
BANKING RELATIONSHIPS	Number of banking relationships defined at the banking group level, based on the relevance of each group in firm's total banking debt
CHANGE_BANK_REL	Changes in the number of independent banking relationships in the year
CREDIT LINE	Dummy variable that takes the value 1 if the firm has unused credit lines
Macroeconomic variables	
GDP	Annual growth rate of GDP
INT_RATE	Average interest rate applied on loans granted to the non-financial corporations

Table I.2: Correlation matrix

	DEFAULT	WORKING CAP	TURNOV.	CASH & EQ	ACC PAYABLE	ACC RECEIV.	INVENT.	TAX LIAB.	SOCIAL SEC.	OTHER TAXES	INVEST. TUR.	DEBT COV.	LEVERAGE	INTEREST COV.	SD CASHF	SALE GROWTH	SIZE	AGE	Δ EMPL	CREDIT LINE	BANK REL.	PROFIT.	Δ BANK REL.
DEFAULT	1.000																						
WORKING CAP	-0.057	1.000																					
TURNOVER	-0.085	0.000	1.000																				
CASH & EQ	-0.041	0.276	0.133	1.000																			
ACC. PAYABLE	0.157	-0.088	-0.366	-0.185	1.000																		
ACC. RECEIVABLE	0.067	0.263	-0.348	-0.146	0.393	1.000																	
INVENTORIES	0.036	0.020	-0.259	-0.110	0.209	0.023	1.000																
TAX LIABILITIES	0.151	-0.098	0.169	0.055	-0.006	-0.033	-0.046	1.000															
SOCIAL SEC	0.165	-0.075	-0.034	-0.034	0.092	0.032	0.012	0.412	1.000														
OTHER TAXES	0.117	-0.068	0.192	0.070	-0.043	-0.048	-0.053	0.920	0.111	1.000													
INVESTMENT TUR.	-0.016	0.186	0.184	0.067	-0.023	0.005	-0.018	0.054	0.004	0.058	1.000												
DEBT COVERAGE	-0.064	0.259	0.196	0.513	-0.243	-0.094	-0.149	0.052	-0.065	0.077	-0.009	1.000											
LEVERAGE	0.099	-0.555	0.004	-0.409	0.226	-0.037	0.065	0.169	0.136	0.140	-0.018	-0.501	1.000										
INTEREST COV	-0.015	0.056	0.048	0.143	-0.041	-0.028	-0.019	0.007	-0.019	0.014	0.025	0.162	-0.096	1.000									
SD CASHF	0.032	-0.178	0.181	0.040	-0.058	-0.117	-0.046	0.253	0.088	0.245	0.010	-0.023	0.253	0.000	1.000								
SALE GROWTH	-0.078	-0.078	0.145	-0.008	-0.097	-0.105	-0.112	0.008	-0.035	0.019	0.020	0.133	0.030	0.019	-0.011	1.000							
SIZE	0.030	0.122	-0.289	-0.121	0.109	0.220	0.011	-0.297	-0.058	-0.301	-0.023	-0.037	-0.157	-0.009	-0.309	-0.002	1.000						
AGE	-0.006	0.225	-0.123	0.076	-0.005	0.118	0.054	-0.137	-0.032	-0.135	0.016	0.032	-0.297	0.003	-0.161	-0.167	0.361	1.000					
Δ EMPL	-0.058	-0.042	0.066	-0.010	-0.052	-0.038	-0.062	-0.008	-0.037	0.002	-0.021	0.057	0.014	0.004	0.004	0.302	0.006	-0.142	1.000				
CREDIT LINE	-0.024	0.099	-0.050	-0.063	0.012	0.100	-0.012	-0.138	-0.046	-0.134	-0.004	-0.021	-0.058	0.000	-0.113	-0.018	0.341	0.175	0.003	1.000			
BANK RELATIONSHIPS	-0.071	-0.049	0.106	0.161	-0.080	-0.161	-0.006	0.094	-0.006	0.105	0.069	0.087	-0.033	0.085	0.123	0.019	-0.379	-0.150	-0.015	-0.323	1.000		
PROFITABILITY	-0.069	0.180	0.219	0.181	-0.188	-0.069	-0.165	0.056	-0.066	0.083	-0.027	0.727	-0.373	0.091	-0.122	0.242	-0.026	-0.047	0.113	-0.005	-0.005	1.000	
Δ BANK REL	-0.035	0.045	-0.012	-0.028	-0.010	0.012	-0.007	-0.045	-0.030	-0.041	-0.022	-0.030	0.024	-0.008	-0.017	0.054	0.029	-0.051	0.074	0.084	-0.290	0.004	1.000

Note: DEFAULT - Dummy variable that takes the value 1 if the firm has payments in delay at least longer than 3 months in its bank credit; WORKING CAP - Current assets net of short-term liabilities over total assets; DEBT COV. - Earning before interest, depreciation, and amortization over total debt; LEVERAGE - Total debt over total assets; INTEREST COV - Earning before interests, depreciation, and amortization over interest paid; TURNOVER - Sales over total assets; SALE GROWTH - Sales growth is defined as the difference of the natural logarithm of real sales; SD CASHF - Standard deviation of cashflow over total assets; SIZE - Natural logarithm of real sales; Δ EMPL - Change of the number of employees in the year; CASH & EQ - Cash and equivalents over total debt; ACC. PAYABLE - Accounts payable - (Total trade credits /(purchases of goods for resale, raw materials, secondary and consumable + supplies & external services)); ACC. RECEIVALE - Accounts receivable - (Total trade credits to customers/turnover) ; INVENTORIES - (Inventories/ Cost of goods sold); INVESTIMENT TUR. - Sales over investment; TAX LIABILITIES - Short-term liabilities to General Government over total assets; AGE - Natural logarithm of age in years (plus one); BANK RELATIONSHIPS - Number of banking relationships defined at the banking group level, based on the weight of each group in firm's total banking debt; Δ BANK REL - Changes in the number of independent banking relationships in the year; CREDIT LINE - Dummy variable that takes the value 1 if the firm has unused credit lines; PROFITABILITY - Operational income over total assets.

Table I.3: Logit regression - Dependent variable: default - Activity indicators

	Model 1		Model 2		Model 3		Model 4	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL	-0.3298***	-0.0030***	-0.2999***	-0.0028***				
	(-5.68)	(-5.43)	(-5.21)	(-5.00)				
TURNOVER	-1.2003***	-0.0111***	-1.1995***	-0.0113***				
	(-26.62)	(-15.14)	(-26.70)	(-15.29)				
CASH & EQUIVALENTS					-0.3139***	-0.0026***	-0.3107***	-0.0026***
					(-3.08)	(-3.04)	(-3.06)	(-3.02)
ACCOUNTS PAYABLE					1.7279***	0.0141***	1.7189***	0.0143***
					(28.23)	(18.14)	(28.36)	(18.34)
ACCOUNTS RECEIVABLE					0.3068***	0.0025***	0.3023***	0.0025***
					(3.63)	(3.58)	(3.59)	(3.55)
INVENTORIES					0.0995***	0.0008***	0.0985***	0.0008***
					(4.00)	(3.94)	(3.99)	(3.93)
TAX LIABILITIES					6.5032***	0.0530***	6.4309***	0.0536***
					(32.61)	(19.80)	(32.75)	(20.00)
INVESTMENT TURNOVER					-0.0034***	-0.0000***	-0.0034***	-0.0000***
					(-4.61)	(-4.48)	(-4.59)	(-4.46)
LEVERAGE	1.6575***	0.0153***	1.6717***	0.0157***	0.8964***	0.0073***	0.8963***	0.0075***
	(18.13)	(14.48)	(18.39)	(14.75)	(9.68)	(9.09)	(9.75)	(9.16)
DEBT COVERAGE	-0.5434***	-0.0050***	-0.5478***	-0.0051***	-1.2083***	-0.0098***	-1.2077***	-0.0101***
	(-4.04)	(-3.90)	(-4.08)	(-3.94)	(-8.37)	(-7.62)	(-8.40)	(-7.65)
INTEREST COVERAGE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(0.38)	(0.38)	(0.39)	(0.39)	(0.18)	(0.18)	(0.21)	(0.21)
SD CASHFLOW	2.1177***	0.0195***	2.1026***	0.0198***	0.5320*	0.0043*	0.5186*	0.0043*
	(8.55)	(7.93)	(8.54)	(7.94)	(1.94)	(1.93)	(1.90)	(1.90)
SALES GROWTH	-0.8297***	-0.0076***	-0.8203***	-0.0077***	-0.8976***	-0.0073***	-0.8884***	-0.0074***
	(-12.35)	(-10.43)	(-12.25)	(-10.40)	(-12.26)	(-10.56)	(-12.18)	(-10.54)
SIZE	0.0744***	0.0007***	0.0730***	0.0007***	0.2998***	0.0024***	0.2968***	0.0025***
	(4.17)	(4.14)	(4.11)	(4.09)	(16.02)	(13.47)	(15.99)	(13.50)
AGE	-0.3929***	-0.0036***	-0.3961***	-0.0037***	-0.4034***	-0.0033***	-0.4052***	-0.0034***
	(-12.67)	(-10.32)	(-12.81)	(-10.46)	(-12.35)	(-10.44)	(-12.47)	(-10.55)
CHANGE-EMPLOYEES	-1.2849***	-0.0118***	-1.2848***	-0.0121***	-1.1728***	-0.0096***	-1.1725***	-0.0098***
	(-11.63)	(-9.75)	(-11.65)	(-9.81)	(-10.22)	(-9.06)	(-10.25)	(-9.10)
CREDIT LINES	-0.6156***	-0.0057***	-0.6092***	-0.0057***	-0.5330***	-0.0043***	-0.5272***	-0.0044***
	(-13.23)	(-12.69)	(-13.16)	(-12.69)	(-10.74)	(-10.88)	(-10.70)	(-10.86)
BANKING RELATIONSHIPS	-2.6191***	-0.0241***	-2.6129***	-0.0245***	-2.5193***	-0.0205***	-2.5119***	-0.0209***
	(-28.46)	(-16.39)	(-28.57)	(-16.55)	(-25.71)	(-16.96)	(-25.83)	(-17.12)
CHANGE_BANK_REL	-0.2494***	-0.0023***	-0.2477***	-0.0023***	-0.1934***	-0.0016***	-0.1913***	-0.0016***
	(-11.89)	(-9.93)	(-11.81)	(-9.92)	(-8.96)	(-8.16)	(-8.88)	(-8.11)
2007	0.2812***	0.0026***			0.3825***	0.0031***		
	(4.70)	(4.61)			(6.06)	(5.92)		
2008	0.5593***	0.0052***			0.7216***	0.0059***		
	(9.61)	(8.93)			(11.72)	(10.62)		
2009	0.6945***	0.0064***			0.7567***	0.0062***		
	(11.25)	(10.42)			(12.10)	(11.18)		
GDP			-0.1467***	-0.0014***			-0.1679***	-0.0014***
			(-11.60)	(-10.60)			(-12.86)	(-11.59)
INT_RATE			0.1799***	0.0017***			0.2590***	0.0022***
			(6.34)	(6.10)			(8.80)	(8.22)
Nr. Observations	195,329		195,329		195,329		195,329	
Nr. Firms	72,649		72,649		72,649		72,649	
Log-likelihood	-14,043.2		-14,054.6		-13,353.2		-13,367.7	
Log-likelihood constant	-16,682.8		-16,682.8		-16,682.8		-16,682.8	
Pseudo-R2	0.158		0.158		0.200		0.199	
Wald Chi2	2,960.2		3,004.9		2,981.6		3,053.8	
Prob > Chi2	0.00		0.00		0.00		0.00	
sigma_u	1.02		0.99		1.23		1.20	
rho	0.24		0.23		0.31		0.30	
Chi2_c	55.95		51.87		117.45		110.73	
BIC	28,452		28,463		27,121		27,137	
AIC	28,146		28,167		26,774		26,801	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a random-effects logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. Z-scores are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects. The marginal effects correspond to the average effects, assuming as baseline firms with credit lines and changes in the number of bank lending relationships. In all regressions a constant and business sector dummies were included. The Pseudo-R^2 is a measure of goodness of the fit, being computed as function of the models log-likelihood and of the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator.

Table I.4: Logit regression by firm dimension - Dependent variable: default

(Continues)

Panel A - Micro and small firms

	Micro				Small			
	Model 1		Model 2		Model 1		Model 2	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL	-0.2815***	-0.0026***			-0.4038***	-0.0040***		
	(-3.38)	(-3.23)			(-4.64)	(-4.39)		
TURNOVER	-0.9336***	-0.0085***			-1.3256***	-0.0130***		
	(-13.64)	(-8.24)			(-18.33)	(-10.44)		
CASH & EQUIVALENTS			-0.1281	-0.0010			-0.9161***	-0.0077***
			(-1.05)	(-1.05)			(-4.60)	(-4.38)
ACCOUNTS PAYABLE			1.2460***	0.0094***			1.9002***	0.0159***
			(14.17)	(9.89)			(20.24)	(12.94)
ACCOUNTS RECEIVABLE			0.0801	0.0006			0.2598**	0.0022**
			(0.65)	(0.65)			(2.08)	(2.05)
INVENTORIES			0.0671*	0.0005*			0.1102***	0.0009***
			(1.91)	(1.90)			(2.98)	(2.95)
TAX LIABILITIES			7.2637***	0.0550***			6.6968***	0.0562***
			(22.49)	(12.34)			(21.82)	(13.83)
INVESTMENT TURNOVER			-0.0030***	-0.0000***			-0.0040***	-0.0000***
			(-3.08)	(-2.98)			(-3.28)	(-3.17)
LEVERAGE	1.3297***	0.0121***	0.8424***	0.0064***	2.1218***	0.0208***	1.1471***	0.0096***
	(10.29)	(8.14)	(6.36)	(5.85)	(14.41)	(11.02)	(7.59)	(7.06)
DEBT COVERAGE	-0.1038	-0.0009	-0.6175***	-0.0047***	-0.4764**	-0.0047**	-1.0620***	-0.0089***
	(-0.57)	(-0.57)	(-2.99)	(-2.87)	(-2.30)	(-2.24)	(-4.67)	(-4.37)
INTEREST COVERAGE	0.0001	0.0000	0.0001	0.0000	-0.0001	-0.0000	-0.0001	-0.0000
	(1.35)	(1.34)	(1.04)	(1.04)	(-0.92)	(-0.92)	(-0.93)	(-0.93)
SD CASHFLOW	2.5959***	0.0236***	1.4896***	0.0113***	1.7038***	0.0167***	0.5380	0.0045
	(7.40)	(6.29)	(3.79)	(3.65)	(4.54)	(4.33)	(1.29)	(1.29)
SALES GROWTH	-0.8992***	-0.0082***	-0.9243***	-0.0070***	-0.7293***	-0.0071***	-0.7909***	-0.0066***
	(-9.29)	(-7.20)	(-8.85)	(-7.32)	(-7.41)	(-6.51)	(-7.45)	(-6.63)
SIZE	0.2581***	0.0023***	0.7114***	0.0054***	0.0934***	0.0009***	0.5104***	0.0043***
	(5.84)	(5.36)	(15.23)	(10.23)	(2.66)	(2.64)	(13.61)	(10.52)
AGE	-0.3062***	-0.0028***	-0.3609***	-0.0027***	-0.4455***	-0.0044***	-0.4323***	-0.0036***
	(-6.55)	(-5.53)	(-7.13)	(-6.10)	(-9.80)	(-7.66)	(-8.90)	(-7.41)
CHANGE-EMPLOYEES	-1.2362***	-0.0112***	-0.9620***	-0.0073***	-1.3624***	-0.0133***	-1.0189***	-0.0085***
	(-7.35)	(-5.88)	(-5.54)	(-4.91)	(-8.76)	(-7.21)	(-6.27)	(-5.77)
CREDIT LINES	-0.6258***	-0.0057***	-0.5637***	-0.0043***	-0.6359***	-0.0062***	-0.5577***	-0.0047***
	(-9.75)	(-8.71)	(-8.18)	(-8.00)	(-9.14)	(-8.63)	(-7.41)	(-7.42)
BANKING RELATIONSHIPS	-3.0289***	-0.0275***	-3.0214***	-0.0229***	-2.3605***	-0.0231***	-2.2961***	-0.0193***
	(-21.88)	(-10.15)	(-19.91)	(-11.06)	(-17.58)	(-10.89)	(-15.90)	(-11.17)
CHANGE_BANK_REL	-0.3704***	-0.0034***	-0.3038***	-0.0023***	-0.1976***	-0.0019***	-0.1453***	-0.0012***
	(-10.26)	(-7.40)	(-8.05)	(-6.71)	(-6.66)	(-5.84)	(-4.73)	(-4.44)
2007	0.2451***	0.0022***	0.3230***	0.0024***	0.3269***	0.0032***	0.4357***	0.0037***
	(2.65)	(2.60)	(3.28)	(3.20)	(3.76)	(3.67)	(4.72)	(4.58)
2008	0.5812***	0.0053***	0.7614***	0.0058***	0.6173***	0.0060***	0.7926***	0.0066***
	(6.59)	(5.80)	(8.04)	(6.90)	(7.28)	(6.66)	(8.74)	(7.84)
2009	0.6071***	0.0055***	0.7232***	0.0055***	0.8148***	0.0080***	0.8867***	0.0074***
	(6.55)	(5.89)	(7.52)	(6.67)	(8.91)	(8.01)	(9.56)	(8.62)
Nr. Observations	83,562		83,562		92,953		92,953	
Nr. Firms	38,969		38,969		35,995		35,995	
Log-likelihood	-6,063.7		-5,700.8		-6,624.8		-6,262.2	
Log-likelihood constant	-7,179.5		-7,179.5		-7,987.2		-7,987.2	
Pseudo-R2	0.155		0.206		0.171		0.216	
Wald Chi2	1,248.6		1,161.7		1,374.7		1,330.0	
Prob > Chi2	0.00		0.00		0.00		0.00	
sigma_u	0.95		1.26		0.98		1.23	
rho	0.22		0.32		0.23		0.32	
Chi2_c	13.99		43.41		21.23		53.08	
BIC	12,467		11,787		13,593		12,913	
AIC	12,187		11,470		13,310		12,592	

(Table I.4 Continued)

Panel B - Medium and large firms

	Medium				Large			
	Model 1		Model 2		Model 1		Model 2	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL	-1.1330***	-0.0116***			0.7042	0.0072		
	(-4.41)	(-3.92)			(1.07)	(0.97)		
TURNOVER	-1.9127***	-0.0196***			-1.0691**	-0.0109*		
	(-8.78)	(-5.66)			(-2.53)	(-1.87)		
CASH & EQUIVALENTS			-0.7762	-0.0073			0.5171	0.0049
			(-0.99)	(-0.98)			(1.51)	(1.25)
ACCOUNTS PAYABLE			3.2408***	0.0307***			2.3131***	0.0219***
			(10.06)	(7.07)			(2.69)	(2.67)
ACCOUNTS RECEIVABLE			-0.7111*	-0.0067*			2.4170**	0.0229
			(-1.82)	(-1.76)			(2.17)	(1.60)
INVENTORIES			-0.1671	-0.0016			0.2420	0.0023
			(-0.99)	(-0.99)			(0.48)	(0.48)
TAX LIABILITIES			6.5764***	0.0622***			1.7118	0.0162
			(8.16)	(6.23)			(0.35)	(0.35)
INVESTMENT TURNOVER			-0.0034	-0.0000			-0.0032	-0.0000
			(-0.88)	(-0.86)			(-0.54)	(-0.53)
LEVERAGE	3.0376***	0.0312***	2.0214***	0.0191***	1.6623**	0.0169*	0.8887	0.0084
	(7.62)	(6.01)	(5.31)	(4.70)	(2.23)	(1.88)	(0.93)	(0.90)
DEBT COVERAGE	-2.1594***	-0.0222***	-3.4483***	-0.0326***	-2.8603**	-0.0291*	-3.0081**	-0.0285*
	(-3.42)	(-3.12)	(-5.30)	(-4.32)	(-2.32)	(-1.72)	(-2.29)	(-1.66)
INTEREST COVERAGE	-0.0016**	-0.0000**	-0.0009	-0.0000	0.0001	0.0000	0.0001	0.0000
	(-2.09)	(-2.03)	(-0.97)	(-0.96)	(0.81)	(0.77)	(0.35)	(0.34)
SD CASHFLOW	2.1967**	0.0226**	1.3678	0.0129	-1.0587	-0.0108	-1.6972	-0.0161
	(2.08)	(2.02)	(1.17)	(1.17)	(-0.24)	(-0.24)	(-0.36)	(-0.36)
SALES GROWTH	-0.5541*	-0.0057*	-0.8586***	-0.0081**	-1.5966*	-0.0162	-1.0226	-0.0097
	(-1.87)	(-1.82)	(-2.70)	(-2.52)	(-1.72)	(-1.42)	(-1.01)	(-0.96)
SIZE	-0.2011**	-0.0021**	0.3653***	0.0035***	0.0030	0.0000	0.0930	0.0009
	(-2.28)	(-2.17)	(4.07)	(3.68)	(0.01)	(0.01)	(0.42)	(0.42)
AGE	-0.1024	-0.0011	-0.0334	-0.0003	-0.2242	-0.0023	-0.1894	-0.0018
	(-0.88)	(-0.87)	(-0.28)	(-0.28)	(-0.86)	(-0.76)	(-0.68)	(-0.62)
CHANGE-EMPLOYEES	-1.6962***	-0.0174***	-1.2318**	-0.0117**	0.7051	0.0072	0.1911	0.0018
	(-3.35)	(-3.07)	(-2.40)	(-2.28)	(0.65)	(0.65)	(0.17)	(0.17)
CREDIT LINES	-0.4765*	-0.0049*	0.0411	0.0004	-1.5594**	-0.0159**	-0.8517	-0.0081
	(-1.69)	(-1.71)	(0.13)	(0.13)	(-2.01)	(-2.11)	(-1.01)	(-1.05)
BANKING RELATIONSHIPS	-2.0131***	-0.0207***	-2.2131***	-0.0209***	-0.2355	-0.0024	-0.4260	-0.0040
	(-5.47)	(-4.42)	(-5.54)	(-4.58)	(-0.30)	(-0.29)	(-0.51)	(-0.48)
CHANGE_BANK_REL	-0.1241**	-0.0013*	-0.0829	-0.0008	-0.1292	-0.0013	-0.1587	-0.0015
	(-1.99)	(-1.94)	(-1.29)	(-1.29)	(-0.92)	(-0.86)	(-1.07)	(-0.98)
2007	0.1697	0.0017	0.2648	0.0025	1.4191**	0.0144**	1.4988**	0.0142**
	(0.82)	(0.82)	(1.21)	(1.21)	(2.41)	(1.97)	(2.41)	(1.99)
2008	0.0935	0.0010	0.2194	0.0021	-0.4756	-0.0048	-0.2268	-0.0021
	(0.44)	(0.44)	(0.98)	(0.99)	(-0.65)	(-0.62)	(-0.29)	(-0.29)
2009	0.8110***	0.0083***	0.5588**	0.0053***	0.5690	0.0058	0.9925	0.0094
	(3.60)	(3.65)	(2.54)	(2.60)	(0.92)	(0.94)	(1.58)	(1.46)
Nr. Observations	16,204		16,204		2,610		2,610	
Nr. Firms	5,951		5,951		906		906	
Log-likelihood	-986.0		-946.4		-139.6		-132.5	
Log-likelihood constant	-1,328.7		-1,328.7		-196.3		-196.3	
Pseudo-R2	0.258		0.288		0.289		0.325	
Wald Chi2	287.1		270.3		67.4		67.3	
Prob > Chi2	0.00		0.00		0.00		0.00	
sigma_u	0.93		1.05		0.43		0.59	
rho	0.21		0.25		0.05		0.10	
Chi2_c	4.40		5.77		0.04		0.17	
BIC	2,263		2,222		515		533	
AIC	2,032		1,961		339		333	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a random-effects logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. Z-scores are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects. The marginal effects correspond to the average effects, assuming as baseline firms with credit lines and changes in the number of bank lending relationships. In all regressions a constant and business sector dummies were included. The Pseudo-R^2 is a measure of goodness of the fit, being computed as function of the models log-likelihood and of the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator.

Table I.5: Logit regression - Dependent variable: default - with lag regressors

	Model 1		Model 2		Model 3	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL$_{t-1}$	-0.3255***	-0.0046***				
	(-3.84)	(-3.69)				
TURNOVER$_{t-1}$	-1.0266***	-0.0144***				
	(-19.96)	(-11.01)				
CASH & EQUIVALENTS$_{t-1}$			-0.5727***	-0.0070***	-0.5219***	-0.0064***
			(-3.91)	(-3.74)	(-3.60)	(-3.47)
ACCOUNTS PAYABLE$_{t-1}$			1.4550***	0.0177***	1.4223***	0.0174***
			(17.89)	(11.76)	(17.46)	(11.72)
ACCOUNTS RECEIVABLE$_{t-1}$			-0.1537	-0.0019	-0.1546	-0.0019
			(-1.32)	(-1.32)	(-1.33)	(-1.32)
INVENTORIES$_{t-1}$			0.1239***	0.0015***	0.1247***	0.0015***
			(3.69)	(3.61)	(3.71)	(3.63)
TAX LIABILITIES$_{t-1}$			5.5371***	0.0673***		
			(20.40)	(13.19)		
INVESTMENT TURNOVER$_{t-1}$			-0.0045***	-0.0001***	-0.0045***	-0.0001***
			(-3.65)	(-3.50)	(-3.66)	(-3.52)
SOCIAL SEC. LIABILITIES$_{t-1}$					9.6421***	0.1178***
					(16.17)	(11.94)
OTHER TAXES$_{t-1}$					4.5341***	0.0554***
					(14.71)	(11.34)
LEVERAGE$_{t-1}$	1.3440***	0.0189***	0.7078***	0.0086***	0.7064***	0.0086***
	(10.47)	(9.18)	(5.61)	(5.38)	(5.58)	(5.35)
DEBT COVERAGE$_{t-1}$	-1.0915***	-0.0153***	-1.8201***	-0.0221***	-1.7671***	-0.0216***
	(-6.05)	(-5.45)	(-9.97)	(-8.06)	(-9.64)	(-7.91)
INTEREST COVERAGE$_{t-1}$	-0.0004**	-0.0000**	-0.0005**	-0.0000**	-0.0005**	-0.0000**
	(-2.08)	(-2.05)	(-2.30)	(-2.27)	(-2.28)	(-2.25)
SD CASHFLOW$_{t-1}$	3.6358***	0.0511***	2.5948***	0.0315***	2.6409***	0.0323***
	(12.10)	(9.57)	(8.14)	(7.23)	(8.27)	(7.34)
SALES GROWTH$_{t-1}$	-0.2315***	-0.0033**	-0.3534***	-0.0043***	-0.3571***	-0.0044***
	(-2.61)	(-2.56)	(-3.74)	(-3.60)	(-3.78)	(-3.64)
SIZE$_{t-1}$	0.0599***	0.0008***	0.2329***	0.0028***	0.2286***	0.0028***
	(2.86)	(2.84)	(10.97)	(9.20)	(10.76)	(9.10)
AGE	-0.3823***	-0.0054***	-0.4116***	-0.0050***	-0.4130***	-0.0050***
	(-9.20)	(-7.52)	(-9.68)	(-7.86)	(-9.71)	(-7.90)
CHANGE-EMPLOYEES$_{t-1}$	-0.5788***	-0.0081***	-0.5653***	-0.0069***	-0.5587***	-0.0068***
	(-4.46)	(-4.23)	(-4.23)	(-4.03)	(-4.18)	(-3.99)
CREDIT LINES$_{t-1}$	-0.1533***	-0.0022***	-0.1402**	-0.0017**	-0.1384**	-0.0017**
	(-2.63)	(-2.69)	(-2.32)	(-2.38)	(-2.29)	(-2.34)
BANKING RELATIONSHIPS$_{t-1}$	-2.4250***	-0.0341***	-2.3297***	-0.0283***	-2.3152***	-0.0283***
	(-21.59)	(-11.82)	(-20.02)	(-11.92)	(-19.92)	(-11.99)
CHANGE_BANK_REL$_{t-1}$	0.0710***	0.0010***	0.0940***	0.0011***	0.0943***	0.0012***
	(2.81)	(2.72)	(3.70)	(3.54)	(3.70)	(3.55)
2007	-0.5294***	-0.0074***	-0.6506***	-0.0079***	-0.6510***	-0.0080***
	(-8.67)	(-7.77)	(-10.27)	(-8.91)	(-10.27)	(-8.93)
2008	-0.1477***	-0.0021***	-0.1799***	-0.0022***	-0.1757***	-0.0021***
	(-2.72)	(-2.72)	(-3.26)	(-3.23)	(-3.18)	(-3.16)
Nr. Observations	119,553		119,553		119,553	
Nr. Firms	54,003		54,003		54,003	
Log-likelihood	-8,731.5		-8,615.9		-8,587.3	
Log-likelihood constant	-10,024.5		-10,024.5		-10,024.5	
Pseudo-R2	0.129		0.141		0.143	
Wald Chi2	1,666.5		1,645.6		1,675.9	
Prob > Chi2	0.00		0.00		0.00	
sigma_u	0.42		0.73		0.72	
rho	0.05		0.14		0.14	
Chi2_c	0.83		8.17		7.75	
BIC	17,802		17,618		17,572	
AIC	17,521		17,298		17,243	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a random-effects logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. Z-scores are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects. The marginal effects correspond to the average effects, assuming as baseline firms with credit lines and changes in the number of bank lending relationships. In all regressions a constant and business sector dummies were included. The Pseudo-R^2 is a measure of goodness of the fit, being computed as function of the models log-likelihood and of the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator.

Table I.6: Dependent variable: default - Without bank lending variables

	Model 1		Model 2		Model 3		Model 4	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL	-0.3369***	-0.0033***	-0.3072***	-0.0031***				
	(-5.86)	(-5.57)	(-5.39)	(-5.15)				
TURNOVER	-1.1006***	-0.0108***	-1.0999***	-0.0110***				
	(-25.52)	(-14.75)	(-25.61)	(-14.93)				
CASH & EQUIVALENTS					-0.4591***	-0.0040***	-0.4572***	-0.0040***
					(-4.45)	(-4.32)	(-4.45)	(-4.32)
ACCOUNTS PAYABLE					1.6890***	0.0146***	1.6796***	0.0148***
					(27.81)	(18.25)	(27.94)	-18.47
ACCOUNTS RECEIVABLE					0.4011***	0.0035***	0.3957***	0.0035***
					(4.8)	(4.69)	(4.76)	(4.66)
INVENTORIES					0.0899***	0.0008***	0.0885***	0.0008***
					(3.62)	(3.58)	(3.59)	(3.55)
TAX LIABILITIES					6.6665***	0.0576***	6.5876***	0.0581***
					(33.07)	(20.28)	(33.22)	(20.51)
INVESTMENT TURNOVER					-0.0047***	-0.0000***	-0.0046***	-0.0000***
					(-6.03)	(-5.73)	(-6.02)	(-5.73)
LEVERAGE	1.7293***	0.0169***	1.7409***	0.0174***	0.9644***	0.0083***	0.9630***	0.0085***
	(19.11)	(14.87)	(19.36)	(15.17)	(10.62)	(9.85)	(10.68)	(9.93
DEBT COVERAGE	-0.4771***	-0.0047***	-0.4817***	-0.0048***	-1.0265***	-0.0089***	-1.0259***	-0.0091***
	(-3.73)	(-3.60)	(-3.77)	(-3.64)	(-7.35)	(-6.81)	(-7.38)	(-6.85)
INTEREST COVERAGE	-0.0001	0.0000	-0.0001	0.0000	-0.0001	0.0000	-0.0001	0.0000
	(-1.35)	(-1.34)	(-1.33)	(-1.33)	(-1.28)	(-1.28)	(-1.26)	(-1.25)
SD CASHFLOW	2.1600***	0.0211***	2.1485***	0.0214***	0.6249**	0.0054**	0.6156**	0.0054**
	(8.72)	(8.00)	(8.73)	(8.03)	(2.29)	(2.28)	(2.20)	(2.26)
SALES GROWTH	-0.9141***	-0.0089***	-0.9045***	-0.0090***	-0.9587***	-0.0083***	-0.9493***	-0.0084***
	(-13.75)	(-11.10)	(-13.65)	(-11.11)	(-13.26)	(-11.15)	(-13.18)	(-11.15)
SIZE	0.1876***	0.0018***	0.1863***	0.0019***	0.4025***	0.0035***	0.3993***	0.0035***
	(11.52)	(9.94)	(11.51)	(9.97)	(22.72)	(16.14)	(22.77)	(16.26)
AGE	-0.3627***	-0.0035***	-0.3661***	-0.0037***	-0.3805***	-0.0033***	-0.3826***	-0.0034***
	(-11.91)	(-9.88)	(-12.07)	(-10.03)	(-11.88)	(-10.19)	(-12.00)	(-10.31)
CHANGE-EMPLOYEES	-1.3491***	-0.0132***	-1.3493***	-0.0135***	-1.1965***	-0.0103***	-1.1959***	-0.0106***
	(-12.13)	(-9.87)	(-12.16)	(-9.94)	(-10.40)	(-9.13)	(-10.42)	(-9.18)
2007	0.2943***	0.0029***			0.3973***	0.0034***		
	(4.92)	(4.81)			(6.3)	(6.12)		
2008	0.5560***	0.0054***			0.7315***	0.0063***		
	(9.58)	(8.84)			(11.91)	(10.7)		
2009	0.6835***	0.0067***			0.7734***	0.0067***		
	(11.18)	(10.3)			(12.46)	(11.37)		
GDP			-0.1428***	-0.0014***			-0.1698***	-0.0015***
			(-11.39)	(-10.38)			(-13.11)	(-11.68)
INT_RATE			0.1792***	0.0018***			0.2602***	0.0023***
			(6.34)	(6.08)			(8.87)	(8.26
Nr. Observations	195,329		195,329		195,329		195,329	
Nr. Firms	72,649		72,649		72,649		72,649	
Log-likelihood	-14,550.5		-14,562.8		-13,353.2		-13,367.7	
Pseudo-R2	0.128		0.127		0.200		0.199	
Wald Chi2	2,577.1		2,616.2		2,981.6		3,053.8	
Prob > Chi2	0.00		0.00		0.00		0.00	
Rho	0.29		0.28		0.31		0.30	
Chi2_c	81.52		76.82		117.45		110.73	
BIC	29,430		29,442		27,121		27,137	
AIC	29,155		29,178		26,774		26,801	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a random-effects logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. Z-scores are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects. The marginal effects correspond to the average effects, assuming as baseline firms with credit lines and changes in the number of bank lending relationships. In all regressions a constant and business sector dummies were included. The Pseudo-R^2 is a measure of goodness of the fit, being computed as function of the models log-likelihood and the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator.

Table I.7: Dependent variable: default - Without bank lending variables - lag regressors

	Model 1		Model 2		Model 3	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL$_{t-1}$	-0.3404***	-0.0045***				
	(-4.10)	(-3.89)				
TURNOVER$_{t-1}$	-0.9213***	-0.0121***				
	(-18.75)	(-10.23)				
CASH & EQUIVALENTS$_{t-1}$			-0.7642***	-0.0090***	-0.7076***	-0.0084***
			(-5.19)	(-4.75)	(-4.85)	(-4.49)
ACCOUNTS PAYABLE$_{t-1}$			1.3450***	0.0158***	1.3124***	0.0155***
			(16.76)	(11.26)	(16.32)	(11.22)
ACCOUNTS RECEIVABLE$_{t-1}$			-0.0235	-0.0003	-0.027	-0.0003
			(-0.21)	(-0.21)	(-0.24)	(-0.24)
INVENTORIES$_{t-1}$			0.1154***	0.0014***	0.1164***	0.0014***
			(3.48)	(3.40)	(3.51)	(3.43)
TAX LIABILITIES$_{t-1}$			5.4797***	0.0645***		
			(20.17)	(12.72)		
INVESTMENT TURNOVER$_{t-1}$			-0.0061***	-0.0001***	-0.0060***	-0.0001***
			(-4.78)	(-4.43)	(-4.74)	(-4.42)
SOCIAL SEC. LIABILITIES$_{t-1}$					9.8454***	0.1165***
					(16.33)	(11.69)
OTHER TAXES$_{t-1}$					4.4245***	0.0524***
					(14.36)	(10.95)
LEVERAGEt-1	1.4001***	0.0183***	0.7920***	0.0093***	0.7897***	0.0093***
	(11.13)	(9.30)	(6.50)	(6.08)	(6.47)	(6.06)
DEBT COVERAGEt-1	-0.9784***	-0.0128***	-1.5794***	-0.0186***	-1.5252***	-0.0180***
	(-5.68)	(-5.06)	(-8.94)	(-7.37)	(-8.60)	(-7.20)
INTEREST COVERAGEt-1	-0.0006***	-0.0000***	-0.0006***	-0.0000***	-0.0006***	-0.0000***
	(-2.97)	(-2.90)	(-3.14)	(-3.07)	(-3.12)	(-3.05)
SD CASHFLOWt-1	3.6616***	0.0479***	2.6447***	0.0311***	2.6973***	0.0319***
	(11.96)	(9.14)	(8.27)	(7.23)	(8.42)	(7.35)
SALES GROWTHt-1	-0.2432***	-0.0032***	-0.3422***	-0.0040***	-0.3477***	-0.0041***
	(-2.77)	(-2.70)	(-3.68)	(-3.53)	(-3.74)	(-3.59)
SIZEt-1	0.2288***	0.0030***	0.3757***	0.0044***	0.3703***	0.0044***
	(12.2	(8.93)	(19.11)	(11.52)	(18.82)	(11.55)
AGE	-0.3596***	-0.0047***	-0.3911***	-0.0046***	-0.3924***	-0.0046***
	(-8.81)	(-7.12)	(-9.40)	(-7.60)	(-9.42)	(-7.65)
CHANGE-EMPLOYEESt-1	-0.4944***	-0.0065***	-0.4492***	-0.0053***	-0.4431***	-0.0052***
	(-3.79)	(-3.61)	(-3.37)	(-3.25)	(-3.32)	(-3.21)
2007	-0.5539***	-0.0072***	-0.6759***	-0.0080***	-0.6776***	-0.0080***
	(-9.02)	(-7.81)	(-10.69)	(-8.91)	(-10.70)	(-8.95)
2008	-0.1620***	-0.0021***	-0.1976***	-0.0023***	-0.1920***	-0.0023***
	(-2.98)	(-2.97)	(-3.59)	(-3.53)	(-3.49)	(-3.43)
Nr. Observations	119,553		119,553		119,553	
Nr. Firms	54,003		54,003		54,003	
Log-likelihood	-9,037.2		-8,890.2		-8,858.5	
Pseudo-R2	0.098		0.113		0.116	
Wald Chi2	1,318.9		1,403.6		1,437.8	
Prob > Chi2	0.00		0.00		0.00	
rho	0.12		0.18		0.17	
Chi2_c	4.71		12.66		12.28	
BIC	18,378		18,131		18,080	
AIC	18,126		17,840		17,779	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a random-effects logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. Z-scores are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects. The marginal effects correspond to the average effects, assuming as baseline firms with credit lines and changes in the number of bank lending relationships. In all regressions a constant and business sector dummies were included. The Pseudo-R^2 is a measure of goodness of the fit, being computed as function of the models log-likelihood and of the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator.

Table I.8: Dependent variable: default - Cash cycle and Government net position

	Model 1		Model 2		Model 3		Model 4	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL	-0.3298***	-0.0030***						
	(-5.68)	(-5.43)						
TURNOVER	-1.2003***	-0.0111***						
	(-26.62)	(-15.14)						
CASH & EQUIVALENTS			-0.3139***	-0.0026***	-0.4716***	-0.0037***	-0.3013***	-0.0025***
			(-3.08)	(-3.04)	(-4.54)	(-4.39)	(-2.98)	(-2.94)
ACCOUNTS PAYABLE			1.7279***	0.0141***			1.6938***	0.0140***
			(28.23)	(18.14)			(27.92)	(18.06)
ACCOUNTS RECEIVABLE			0.3068***	0.0025***			0.2841***	0.0024***
			(3.63)	(3.58)			(3.38)	(3.34)
INVENTORIES			0.0995***	0.0008***			0.0881***	0.0007***
			(4.00)	(3.94)			(3.55)	(3.51)
TAX LIABILITIES			6.5032***	0.0530***	6.3315***	0.0492***		
			(32.61)	(19.80)	(32.23)	(18.39)		
INVESTMENT TURNOVER			-0.0034***	-0.0000***	-0.0039***	-0.0000***	-0.0031***	-0.0000***
			(-4.61)	(-4.48)	(-5.16)	(-4.92)	(-4.25)	(-4.15)
CASH CYCLE					-0.0001	0.0000		
					(-0.86)	(-0.86)		
GOVERNMENT NET POSITION							6.2856***	0.0521***
							(32.51)	(19.62)
LEVERAGE	1.6575***	0.0153***	0.8964***	0.0073***	1.2496***	0.0097***	1.0031***	0.0083***
	(18.13)	(14.48)	(9.68)	(9.09)	(14.33)	(12.13)	(10.84)	(10.02)
DEBT COVERAGE	-0.5434***	-0.0050***	-1.2083***	-0.0098***	-1.7061***	-0.0133***	-1.1489***	-0.0095***
	(-4.04)	(-3.90)	(-8.37)	(-7.62)	(-12.21)	(-10.00)	(-7.94)	(-7.27)
INTEREST COVERAGE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(0.38)	(0.38)	(0.18)	(0.18)	(0.43)	(0.43)	(0.28)	(0.28)
SD CASHFLOW	2.1177***	0.0195***	0.5320*	0.0043*	-0.4730*	-0.0037*	0.7215***	0.0060***
	(8.55)	(7.93)	(1.94)	(1.93)	(-1.70)	(-1.69)	(2.65)	(2.64)
SALES GROWTH	-0.8297***	-0.0076***	-0.8976***	-0.0073***	-1.2206***	-0.0095***	-0.9094***	-0.0075***
	(-12.35)	(-10.43)	(-12.26)	(-10.56)	(-16.79)	(-12.39)	(-12.47)	(-10.69)
SIZE	0.0744***	0.0007***	0.2998***	0.0024***	0.3174***	0.0025***	0.2703***	0.0022***
	(4.17)	(4.14)	(16.02)	(13.47)	(-17.43)	(13.91)	(14.59)	-12.53
AGE	-0.3929***	-0.0036***	-0.4034***	-0.0033***	-0.3909***	-0.0030***	-0.3901***	-0.0032***
	(-12.67)	(-10.32)	(-12.35)	(-10.44)	(-12.25)	(-10.05)	(-11.98)	(-10.20)
CHANGE-EMPLOYEES	-1.2849***	-0.0118***	-1.1728***	-0.0096***	-1.3076***	-0.0102***	-1.1575***	-0.0096***
	(-11.63)	(-9.75)	(-10.22)	(-9.06)	(-11.40)	(-9.54)	(-10.11)	(-8.97)
CREDIT LINES	-0.6156***	-0.0057***	-0.5330***	-0.0043***	-0.6116***	-0.0048***	-0.5292***	-0.0044***
	(-13.23)	(-12.69)	(-10.74)	(-10.88)	(-12.46)	(-11.89)	(-10.71)	(-10.88)
BANKING RELATIONSHIPS	-2.6191***	-0.0241***	-2.5193***	-0.0205***	-2.4255***	-0.0189***	-2.4833***	-0.0206***
	(-28.46)	(-16.39)	(-25.71)	(-16.96)	(-25.33)	(-15.77)	(-25.51)	(-16.91)
CHANGE_BANK_REL	-0.2494***	-0.0023***	-0.1934***	-0.0016***	-0.2097***	-0.0016***	-0.1910***	-0.0016***
	(-11.89)	(-9.93)	(-8.96)	(-8.16)	(-9.90)	(-8.65)	(-8.86)	(-8.08)
2007	0.2812***	0.0026***	0.3825***	0.0031***	0.3674***	0.0029***	0.4038***	0.0033***
	(4.70)	(4.61)	(6.06)	(5.92)	(5.92)	(5.74)	(6.41)	(6.23)
2008	0.5593***	0.0052***	0.7216***	0.0059***	0.6751***	0.0052***	0.7525***	0.0062***
	(9.61)	(8.93)	(11.72)	(10.62)	(11.13)	(10.04)	(12.22)	(10.98)
2009	0.6945***	0.0064***	0.7567***	0.0062***	0.7341***	0.0057***	0.7745***	0.0064***
	(11.25)	(10.42)	(12.10)	(11.18)	(11.86)	(10.89)	(12.39)	(11.4)
Nr. Observations	195,329		195,329		195,329		195,329	
Nr. Firms	72,649		72,649		72,649		72,649	
Log-likelihood	-14,043.2		-13,353.2		-13,932.6		-13,358.5	
Log-likelihood constant	-16,682.8		-16,682.8		-16,682.8		-16,682.8	
Pseudo-R2	0.158		0.200		0.165		0.199	
Wald Chi2	2,960.2		2,981.6		2,798.8		3,011.3	
Prob > Chi2	0.00		0.00		0.00		0.00	
sigma_u	1.02		1.23		1.25		1.21	
rho	0.24		0.31		0.32		0.31	
Chi2_c	55.95		117.45		117.41		110.11	
BIC	28,452		27,121		28,255		27,131	
AIC	28,146		26,774		27,929		26,785	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a random-effects logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. Z-scores are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects. The marginal effects correspond to the average effects, assuming as baseline firms with credit lines and changes in the number of bank lending relationships. In all regressions a constant and business sector dummies were included. The Pseudo-R^2 is a measure of goodness of the fit, being computed as function of the models log-likelihood and of the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator.

Table I.9: Dependent variable: default - Cash cycle and Government net position - lag regressors

	Model 1		Model 2		Model 3		Model 4	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL$_{t-1}$	-0.3255***	-0.0046***						
	(-3.84)	(-3.69)						
TURNOVER$_{t-1}$	-1.0266***	-0.0144***						
	(-19.96)	(-11.01)						
CASH & EQUIVALENTS$_{t-1}$			-0.5727***	-0.0070***	-0.6631***	-0.0076***	-0.5463***	-0.0068***
			(-3.91)	(-3.74)	(-4.47)	(-4.18)	(-3.77)	(-3.62)
ACCOUNTS PAYABLE$_{t-1}$			1.4550***	0.0177***			1.4248***	0.0178***
			(17.89)	(11.76)			(17.7)	(11.78)
ACCOUNTS RECEIVABLE$_{t-1}$			-0.1537	-0.0019			-0.1799	-0.0022
			(-1.32)	(-1.32)			(-1.56)	(-1.55)
INVENTORIES$_{t-1}$			0.1239***	0.0015***			0.1099***	0.0014***
			(3.69)	(3.61)			(3.28)	(3.22)
TAX LIABILITIES$_{t-1}$			5.5371***	0.0673***	10.1983***	0.1185***		
			(20.40)	(13.19)	(17.00)	(-11.72)		
INVESTMENT TURNOVER$_{t-1}$			-0.0045***	-0.0001***	-0.0056***	-0.0001***	-0.0041***	-0.0001***
			(-3.65)	(-3.50)	(-4.30)	(-4.04)	(-3.42)	(-3.29)
CASH CYCLE$_{t-1}$					0.0001	0.0000		
					(0.68)	(0.68)		
GOVERNMENT NET POSITION$_{t-1}$							5.2900***	0.0661***
							(0.27)	(13.03)
LEVERAGE$_{t-1}$	1.3440***	0.0189***	0.7078***	0.0086***	0.9981***	0.0116***	0.8044***	0.0101***
	(10.47)	(9.18)	(5.61)	(5.38)	(8.27)	(7.37)	(6.41)	(6.08)
DEBT COVERAGE$_{t-1}$	-1.0915***	-0.0153***	-1.8201***	-0.0221***	-2.1101***	-0.0245***	-1.7814***	-0.0223***
	(-6.05)	(-5.45)	(-9.97)	(-8.06)	(-11.81)	(-8.81)	(-9.72)	(-7.94)
INTEREST COVERAGE$_{t-1}$	-0.0004**	-0.0000**	-0.0005**	-0.0000**	-0.0004**	-0.0000**	-0.0005**	-0.0000**
	(-2.08)	(-2.05)	(-2.30)	(-2.27)	(-1.98)	(-1.96)	(-2.29)	(-2.26)
SD CASHFLOW$_{t-1}$	3.6358***	0.0511***	2.5948***	0.0315***	2.0598***	0.0239***	2.7615***	0.0345***
	(12.10)	(9.57)	(8.14)	(7.23)	(6.25)	(5.80)	(8.75)	(7.71)
SALES GROWTH$_{t-1}$	-0.2315***	-0.0033**	-0.3534***	-0.0043***	-0.5213***	-0.0061***	-0.3583***	-0.0045***
	(-2.61)	(-2.56)	(-3.74)	(-3.60)	(-5.51)	(-5.06)	(-3.80)	(-3.66)
SIZE$_{t-1}$	0.0599***	0.0008***	0.2329***	0.0028***	0.2306***	0.0027***	0.2122***	0.0027***
	(2.86)	(2.84)	(10.97)	(9.20)	(10.98)	(9.06)	(10.1)	(8.66)
AGE	-0.3823***	-0.0054***	-0.4116***	-0.0050***	-0.4159***	-0.0048***	-0.4012***	-0.0050***
	(-9.20)	(-7.52)	(-9.68)	(-7.86)	(-9.84)	(-7.74)	(-9.47)	(-7.77)
CHANGE-EMPLOYEES$_{t-1}$	-0.5788***	-0.0081***	-0.5653***	-0.0069***	-0.6018***	-0.0070***	-0.5478***	-0.0068***
	(-4.46)	(-4.23)	(-4.23)	(-4.03)	(-4.48)	(-4.21)	(-4.11)	(-3.92)
CREDIT LINES$_{t-1}$	-0.1533***	-0.0022***	-0.1402**	-0.0017**	-0.1895***	-0.0022***	-0.1324**	-0.0017**
	(-2.63)	(-2.69)	(-2.32)	(-2.38)	(-3.14)	(-3.18)	(-2.21)	(-2.26)
BANKING RELATIONSHIPS$_{t-1}$	-2.4250***	-0.0341***	-2.3297***	-0.0283***	-2.2490***	-0.0261***	-2.3021***	-0.0288***
	(-21.59)	(-11.82)	(-20.02)	(-11.92)	(-19.42)	(-11.34)	(-19.94)	(-11.98)
CHANGE_BANK_REL$_{t-1}$	0.0710***	0.0010***	0.0940***	0.0011***	0.0865***	0.0010***	0.0956***	0.0012***
	(2.81)	(2.72)	(3.70)	(3.54)	(3.41)	(3.28)	(3.77)	(3.61)
2007	-0.5294***	-0.0074***	-0.6506***	-0.0079***	-0.6101***	-0.0071***	-0.6738***	-0.0084***
	(-8.67)	(-7.77)	(-10.27)	(-8.91)	(-9.65)	(-8.42)	(-10.64)	(-9.14)
2008	-0.1477***	-0.0021***	-0.1799***	-0.0022***	-0.1479***	-0.0017***	-0.1845***	-0.0023***
	(-2.72)	(-2.72)	(-3.26)	(-3.23)	(-2.68)	(-2.68)	(-3.35)	(-3.32)
Nr. Observations	119,553		119,553		119,553		119,553	
Nr. Firms	54,003		54,003		54,003		54,003	
Log-likelihood	-8,731.5		-8,615.9		-8,805.8		-8,618.4	
Log-likelihood constant	-10,024.5		-10,024.5		-10,024.5		-10,024.5	
Pseudo-R2	0.129		0.141		0.122		0.140268135	
Wald Chi2	1,666.5		1,645.6		1,460.3		1,680.4	
Prob > Chi2	0.00		0.00		0.00		0	
sigma_u	0.42		0.73		0.82		0.6851	
rho	0.05		0.14		0.17		0.1249	
Chi2_c	0.83		8.17		11.09		6.39	
BIC	17,802		17,618		17,974		17,623	
AIC	17,521		17,298		17,674		17,303	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a random-effects logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. Z-scores are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects. The marginal effects correspond to the average effects, assuming as baseline firms with credit lines and changes in the number of bank lending relationships. In all regressions a constant and business sector dummies were included. The Pseudo-R^2 is a measure of goodness of the fit, being computed as function of the models log-likelihood and of the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator.

Table I.10: Alternative econometric approach - Dependent variable: default

	Model 1		Model 2		Model 3		Model 4	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL	-0.3115***	-0.0042***	-0.2893***	-0.0039***				
	(-5.88)	(-5.82)	(-5.45)	(-5.41)				
TURNOVER	-1.1453***	-0.0156***	-1.1474***	-0.0156***				
	(-18.75)	(-17.55)	(-18.78)	(-17.58)				
CASH & EQUIVALENTS					-0.3002**	-0.0040**	-0.2983**	-0.0040**
					(-2.27)	(-2.26)	(-2.25)	(-2.25)
ACCOUNTS PAYABLE					1.4881***	0.0200***	1.4892***	0.0201***
					(31.46)	(26.30)	(31.50)	(26.33)
ACCOUNTS RECEIVABLE					0.2810***	0.0038***	0.2783***	0.0038***
					(3.39)	(3.39)	(3.36)	(3.35)
INVENTORIES					0.0861***	0.0012***	0.0859***	0.0012***
					(3.76)	(3.74)	(3.76)	(3.74)
TAX LIABILITIES					5.3884***	0.0725***	5.3703***	0.0724***
					(36.59)	(29.13)	(36.58)	(29.14)
INVESTMENT TURNOVER					-0.0033***	-0.0000***	-0.0033***	-0.0000***
					(-3.24)	(-3.24)	(-3.24)	(-3.23)
LEVERAGE	1.4505***	0.0197***	1.4693***	0.0200***	0.7990***	0.0108***	0.8032***	0.0108***
	(19.04)	(17.49)	(19.33)	(17.74)	(10.06)	(9.83)	(10.14)	(9.90)
DEBT COVERAGE	-0.5797***	-0.0079***	-0.5825***	-0.0079***	-1.1694***	-0.0157***	-1.1720***	-0.0158***
	(-4.07)	(-4.06)	(-4.08)	(-4.07)	(-8.05)	(-7.96)	(-8.06)	(-7.97)
INTEREST COVERAGE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(0.30)	(0.30)	(0.31)	(0.31)	(0.10)	(0.10)	(0.12)	(0.12)
SD CASHFLOW	1.9325***	0.0263***	1.9277***	0.0262***	0.4737*	0.0064*	0.4656*	0.0063*
	(8.63)	(8.53)	(8.62)	(8.52)	(1.85)	(1.85)	(1.83)	(1.83)
SALES GROWTH	-0.7818***	-0.0106***	-0.7763***	-0.0106***	-0.8455***	-0.0114***	-0.8407***	-0.0113***
	(-11.01)	(-10.83)	(-10.92)	(-10.74)	(-10.73)	(-10.60)	(-10.66)	(-10.53)
SIZE	0.0661***	0.0009***	0.0654***	0.0009***	0.2623***	0.0035***	0.2616***	0.0035***
	(3.84)	(3.86)	(3.80)	(3.82)	(16.94)	(16.59)	(16.90)	(16.56)
AGE	-0.3788***	-0.0052***	-0.3825***	-0.0052***	-0.3715***	-0.0050***	-0.3744***	-0.0050***
	(-12.58)	(-12.25)	(-12.67)	(-12.34)	(-12.37)	(-12.02)	(-12.45)	(-12.09)
CHANGE-EMPLOYEES	-1.2479***	-0.0170***	-1.2495***	-0.0170***	-1.1373***	-0.0153***	-1.1392***	-0.0154***
	(-9.64)	(-9.47)	(-9.65)	(-9.47)	(-8.72)	(-8.60)	(-8.74)	(-8.61)
CREDIT LINES	-0.5715***	-0.0078***	-0.5681***	-0.0077***	-0.4884***	-0.0066***	-0.4861***	-0.0066***
	(-12.84)	(-14.86)	(-12.78)	(-14.79)	(-10.51)	(-11.85)	(-10.48)	(-11.81)
BANKING RELATIONSHIPS	-2.4638***	-0.0335***	-2.4667***	-0.0336***	-2.2803***	-0.0307***	-2.2850***	-0.0308***
	(-28.69)	(-26.74)	(-28.75)	(-26.78)	(-25.65)	(-24.45)	(-25.72)	(-24.51)
CHANGE_BANK_REL	-0.2402***	-0.0033***	-0.2391***	-0.0033***	-0.1844***	-0.0025***	-0.1829***	-0.0025***
	(-11.30)	(-11.05)	(-11.21)	(-10.96)	(-8.81)	(-8.70)	(-8.70)	(-8.60)
2007	0.2503***	0.0034***			0.3187***	0.0043***		
	(4.32)	(4.31)			(5.29)	(5.27)		
2008	0.5020***	0.0068***			0.6203***	0.0084***		
	(9.26)	(9.13)			(11.00)	(10.77)		
2009	0.6087***	0.0083***			0.6267***	0.0084***		
	(10.87)	(10.76)			(10.90)	(10.78)		
GDP			-0.1311***	-0.0018***			-0.1439***	-0.0019***
			(-11.46)	(-11.26)			(-12.19)	(-11.94)
INT_RATE			0.1655***	0.0023***			0.2307***	0.0031***
			(6.25)	(6.19)			(8.50)	(8.36)
Nr. Observations	195,329		195,329		195,329		195,329	
Pseudo R2	0.160		0.160		0.197		0.196	
BIC	28,496		28,502		27,329		27,338	
AIC	28,200		28,217		26,993		27,012	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. The standard errors are robust and clustered at the firm level. t-statistics are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects. The marginal effects correspond to the average, assuming as baseline firms with credit lines and changes in the number of bank lending relationships. In all regressions a constant and business sector dummies were included.

Table I.11: Alternative econometric approach - Dependent variable: default - by firm size

(Continues)

Panel A - Micro and small firms

	Micro				Small			
	Model 1		Model 2		Model 1		Model 2	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL	-0.2654***	-0.0034***			-0.3803***	-0.0053***		
	(-3.48)	(-3.46)			(-4.79)	(-4.74)		
TURNOVER	-0.9023***	-0.0116***			-1.2642***	-0.0176***		
	(-9.83)	(-9.29)			(-12.11)	(-11.57)		
CASH & EQUIVALENTS			-0.1269	-0.0016			-0.8144***	-0.0112***
			(-1.02)	(-1.02)			(-3.52)	(-3.50)
ACCOUNTS PAYABLE			1.0701***	0.0136***			1.6249***	0.0223***
			(15.47)	(13.65)			(22.58)	(19.09)
ACCOUNTS RECEIVABLE			0.0591	0.0008			0.2604**	0.0036**
			(0.49)	(0.49)			(2.17)	(2.18)
INVENTORIES			0.0565*	0.0007*			0.0910***	0.0012***
			(1.79)	(1.78)			(2.71)	(2.70)
TAX LIABILITIES			6.0110***	0.0766***			5.4859***	0.0752***
			(28.01)	(20.23)			(24.72)	(20.16)
INVESTMENT TURNOVER			-0.0029**	-0.0000**			-0.0039**	-0.0001**
			(-2.27)	(-2.26)			(-2.27)	(-2.27)
LEVERAGE	1.1970***	0.0154***	0.7657***	0.0098***	1.8711***	0.0261***	1.0075***	0.0138***
	(11.46)	(10.52)	(6.74)	(6.52)	(15.63)	(14.24)	(7.80)	(7.65)
DEBT COVERAGE	-0.1463	-0.0019	-0.6287***	-0.0080***	-0.5122**	-0.0071**	-1.0454***	-0.0143***
	(-0.81)	(-0.81)	(-3.17)	(-3.16)	(-2.24)	(-2.23)	(-4.34)	(-4.31)
INTEREST COVERAGE	0.0001	0.0000	0.0001	0.0000	-0.0001	-0.0000	-0.0002	-0.0000
	(1.28)	(1.28)	(1.22)	(1.22)	(-1.25)	(-1.25)	(-1.13)	(-1.13)
SD CASHFLOW	2.4031***	0.0310***	1.2819***	0.0163***	1.5668***	0.0219***	0.4665	0.0064
	(7.68)	(7.46)	(3.62)	(3.59)	(4.42)	(4.40)	(1.19)	(1.19)
SALES GROWTH	-0.8495***	-0.0109***	-0.8477***	-0.0108***	-0.6855***	-0.0096***	-0.7414***	-0.0102***
	(-8.28)	(-8.08)	(-7.86)	(-7.71)	(-6.57)	(-6.46)	(-6.68)	(-6.61)
SIZE	0.2374***	0.0031***	0.6214***	0.0079***	0.0856**	0.0012**	0.4444***	0.0061***
	(5.69)	(5.67)	(16.57)	(14.91)	(2.47)	(2.48)	(14.02)	(13.58)
AGE	-0.2962***	-0.0038***	-0.3288***	-0.0042***	-0.4309***	-0.0060***	-0.4019***	-0.0055***
	(-6.55)	(-6.41)	(-7.02)	(-6.84)	(-10.10)	(-9.76)	(-9.21)	(-8.91)
CHANGE-EMPLOYEES	-1.2224***	-0.0158***	-0.9724***	-0.0124***	-1.3124***	-0.0183***	-0.9759***	-0.0134***
	(-6.50)	(-6.34)	(-5.30)	(-5.21)	(-7.12)	(-7.00)	(-5.27)	(-5.23)
CREDIT LINES	-0.5892***	-0.0076***	-0.5233***	-0.0067***	-0.5885***	-0.0082***	-0.5019***	-0.0069***
	(-9.77)	(-12.15)	(-8.35)	(-10.08)	(-8.91)	(-10.03)	(-7.13)	(-7.84)
BANKING RELATIONSHIPS	-2.8683***	-0.0370***	-2.7215***	-0.0347***	-2.2262***	-0.0311***	-2.0655***	-0.0283***
	(-23.17)	(-19.60)	(-20.91)	(-18.46)	(-17.95)	(-17.17)	(-15.96)	(-15.43)
CHANGE_BANK_REL	-0.3543***	-0.0046***	-0.2823***	-0.0036***	-0.1922***	-0.0027***	-0.1411***	-0.0019***
	(-10.16)	(-9.59)	(-8.11)	(-7.81)	(-6.22)	(-6.15)	(-4.59)	(-4.57)
2007	0.2228**	0.0029**	0.2724***	0.0035***	0.2965***	0.0041***	0.3681***	0.0050***
	(2.49)	(2.48)	(2.91)	(2.90)	(3.53)	(3.53)	(4.20)	(4.18)
2008	0.5425***	0.0070***	0.6754***	0.0086***	0.5607***	0.0078***	0.6846***	0.0094***
	(6.49)	(6.36)	(7.69)	(7.49)	(7.11)	(7.00)	(8.29)	(8.11)
2009	0.5575***	0.0072***	0.6275***	0.0080***	0.7274***	0.0101***	0.7428***	0.0102***
	(6.45)	(6.41)	(7.02)	(6.96)	(8.81)	(8.69)	(8.70)	(8.58)
Nr. Observations	83,562		83,562		92,953		92,953	
Pseudo R2	0.158		0.203		0.172		0.212	
BIC	12,470		11,866		13,603		13,009	
AIC	12,199		11,558		13,329		12,697	

(Table I.11 Continued)

Panel B - Medium and large firms

	Medium				Large			
	Model 1		Model 2		Model 1		Model 2	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL	-1.0421***	-0.0144***			0.7122	0.0089		
	(-4.38)	(-4.27)			(1.06)	(1.03)		
TURNOVER	-1.8217***	-0.0251***			-1.0634	-0.0132*		
	(-7.40)	(-7.03)			(-1.63)	(-1.70)		
CASH & EQUIVALENTS			-0.8716	-0.0117			0.5335	0.0066
			(-0.86)	(-0.86)			(1.35)	(1.29)
ACCOUNTS PAYABLE			2.9095***	0.0389***			2.2281***	0.0274***
			(11.48)	(9.93)			(2.80)	(2.92)
ACCOUNTS RECEIVABLE			-0.7178*	-0.0096*			2.4080**	0.0296**
			(-1.73)	(-1.73)			(2.05)	(1.99)
INVENTORIES			-0.1448	-0.0019			0.2686	0.0033
			(-1.05)	(-1.05)			(0.76)	(0.77)
TAX LIABILITIES			6.2034***	0.0829***			-2.3994	-0.0295
			(8.68)	(7.80)			(-0.41)	(-0.41)
INVESTMENT TURNOVER			-0.0046	-0.0001			-0.0032	-0.0000
			(-0.52)	(-0.53)			(-0.52)	(-0.51)
LEVERAGE	2.7572***	0.0380***	1.8015***	0.0241***	1.6308***	0.0203***	0.8686	0.0107
	(7.81)	(7.22)	(5.51)	(5.34)	(2.90)	(2.70)	(1.20)	(1.19)
DEBT COVERAGE	-2.0447***	-0.0282***	-3.0807***	-0.0412***	-2.8537**	-0.0355*	-2.9362**	-0.0361**
	(-3.45)	(-3.39)	(-5.17)	(-4.97)	(-2.17)	(-1.95)	(-2.27)	(-2.03)
INTEREST COVERAGE	-0.0015*	-0.0000*	-0.0010*	-0.0000*	0.0001	0.0000	0.0001	0.0000
	(-1.92)	(-1.91)	(-1.74)	(-1.74)	(1.45)	(1.47)	(0.90)	(0.91)
SD CASHFLOW	2.0807**	0.0287**	1.4207	0.0190	-1.0861	-0.0135	-0.9633	-0.0118
	(2.33)	(2.33)	(1.34)	(1.34)	(-0.29)	(-0.29)	(-0.29)	(-0.29)
SALES GROWTH	-0.5342**	-0.0074**	-0.8392***	-0.0112***	-1.5988**	-0.0199**	-0.9427	-0.0116
	(-2.03)	(-2.03)	(-2.75)	(-2.75)	(-2.30)	(-2.43)	(-1.21)	(-1.28)
SIZE	-0.1881**	-0.0026**	0.3544***	0.0047***	0.0021	0.0000	0.0463	0.0006
	(-2.34)	(-2.31)	(4.66)	(4.63)	(0.01)	(0.01)	(0.24)	(0.24)
AGE	-0.1036	-0.0014	-0.0064	-0.0001	-0.2346	-0.0029	-0.2243	-0.0028
	(-0.92)	(-0.92)	(-0.06)	(-0.06)	(-0.92)	(-0.92)	(-0.81)	(-0.81)
CHANGE-EMPLOYEES	-1.6056***	-0.0221***	-1.1781**	-0.0158**	0.6837	0.0085	0.0867	0.0011
	(-2.93)	(-2.92)	(-2.14)	(-2.14)	(0.49)	(0.49)	(0.06)	(0.06)
CREDIT LINES	-0.4369	-0.0060	0.0348	0.0005	-1.5089*	-0.0188*	-0.7932	-0.0097
	(-1.53)	(-1.57)	(0.11)	(0.11)	(-1.79)	(-1.96)	(-0.80)	(-0.84)
BANKING RELATIONSHIPS	-1.9407***	-0.0267***	-2.0307***	-0.0272***	-0.2644	-0.0033	-0.4919	-0.0060
	(-4.92)	(-5.06)	(-5.09)	(-5.19)	(-0.36)	(-0.36)	(-0.61)	(-0.61)
CHANGE_BANK_REL	-0.1161*	-0.0016*	-0.0714	-0.0010	-0.1300	-0.0016	-0.1637	-0.0020
	(-1.89)	(-1.89)	(-1.16)	(-1.16)	(-0.98)	(-0.97)	(-1.17)	(-1.16)
2007	0.1342	0.0018	0.2300	0.0031	1.3932***	0.0173**	1.4360**	0.0176**
	(0.66)	(0.66)	(1.03)	(1.04)	(2.58)	(2.33)	(2.41)	(2.12)
2008	0.0442	0.0006	0.1469	0.0020	-0.4825	-0.0060	-0.2649	-0.0033
	(0.23)	(0.23)	(0.72)	(0.72)	(-0.64)	(-0.64)	(-0.33)	(-0.34)
2009	0.6761***	0.0093***	0.4200**	0.0056**	0.5363	0.0067	0.9591*	0.0118
	(3.52)	(3.45)	(2.05)	(2.04)	(0.94)	(0.91)	(1.73)	(1.55)
Nr. Observations	15,987		15,987		2,293		2,293	
Pseudo R2	0.259		0.288		0.293		0.329	
BIC	2,247		2,209		457		474	
AIC	2,032		1,963		325		319	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. The standard errors are robust and clustered at the firm level. t-statistics are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects. The marginal effects correspond to the average, assuming as baseline firms with credit lines and changes in the number of bank lending relationships. In all regressions a constant and business sector dummies were included.

Table I.12: Alternative econometric approach - Dependent variable: default - with lag regressors

	Model 1		Model 2		Model 3	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL$_{t-1}$	-0.3232***	-0.0049***				
	(-3.99)	(-3.96)				
TURNOVER$_{t-1}$	-1.0209***	-0.0154***				
	(-14.91)	(-14.04)				
CASH & EQUIVALENTS$_{t-1}$			-0.5635***	-0.0084***	-0.5205***	-0.0078***
			(-3.31)	(-3.30)	(-3.15)	(-3.14)
ACCOUNTS PAYABLE$_{t-1}$			1.3873***	0.0208***	1.3646***	0.0204***
			(20.24)	(17.98)	(19.75)	(17.63)
ACCOUNTS RECEIVABLE$_{t-1}$			-0.1450	-0.0022	-0.1492	-0.0022
			(-1.20)	(-1.20)	(-1.23)	(-1.23)
INVENTORIES$_{t-1}$			0.1170***	0.0018***	0.1177***	0.0018***
			(3.72)	(3.69)	(3.73)	(3.70)
TAX LIABILITIES$_{t-1}$			5.0907***	0.0763***		
			(21.78)	(19.21)		
INVESTMENT TURNOVER$_{t-1}$			-0.0045**	-0.0001**	-0.0044**	-0.0001**
			(-2.27)	(-2.26)	(-2.31)	(-2.30)
SOCIAL SEC. LIABILITIES$_{t-1}$					9.1100***	0.1360***
					(17.49)	(16.09)
OTHER TAXES$_{t-1}$					4.2757***	0.0638***
					(15.12)	(14.15)
LEVERAGE$_{t-1}$	1.3133***	0.0198***	0.6928***	0.0104***	0.6638***	0.0099***
	(11.67)	(11.15)	(6.20)	(6.12)	(5.95)	(5.87)
DEBT COVERAGE$_{t-1}$	-1.0898***	-0.0164***	-1.7684***	-0.0265***	-1.7343***	-0.0259***
	(-5.83)	(-5.78)	(-9.56)	(-9.32)	(-9.29)	(-9.07)
INTEREST COVERAGE$_{t-1}$	-0.0004**	-0.0000**	-0.0005***	-0.0000***	-0.0005***	-0.0000***
	(-2.47)	(-2.47)	(-2.68)	(-2.67)	(-2.62)	(-2.61)
SD CASHFLOW$_{t-1}$	3.5823***	0.0540***	2.4991***	0.0375***	2.5343***	0.0378***
	(12.86)	(12.24)	(8.32)	(8.13)	(8.49)	(8.29)
SALES GROWTH$_{t-1}$	-0.2308**	-0.0035**	-0.3506***	-0.0053***	-0.3515***	-0.0052***
	(-2.51)	(-2.50)	(-3.50)	(-3.48)	(-3.51)	(-3.49)
SIZE$_{t-1}$	0.0588***	0.0009***	0.2215***	0.0033***	0.2196***	0.0033***
	(2.71)	(2.72)	(11.51)	(11.41)	(11.32)	(11.23)
AGE	-0.3804***	-0.0057***	-0.3969***	-0.0059***	-0.4065***	-0.0061***
	(-8.91)	(-8.69)	(-9.46)	(-9.18)	(-9.69)	(-9.39)
CHANGE-EMPLOYEES$_{t-1}$	-0.5751***	-0.0087***	-0.5648***	-0.0085***	-0.5532***	-0.0083***
	(-3.93)	(-3.91)	(-3.75)	(-3.73)	(-3.67)	(-3.66)
CREDIT LINES$_{t-1}$	-0.1509**	-0.0023***	-0.1342**	-0.0020**	-0.1329**	-0.0020**
	(-2.57)	(-2.66)	(-2.25)	(-2.32)	(-2.23)	(-2.29)
BANKING RELATIONSHIPS$_{t-1}$	-2.4056***	-0.0363***	-2.2520***	-0.0337***	-2.2526***	-0.0336***
	(-21.19)	(-19.62)	(-19.84)	(-18.50)	(-19.84)	(-18.52)
CHANGE_BANK_REL$_{t-1}$	0.0716**	0.0011**	0.0942***	0.0014***	0.0945***	0.0014***
	(2.49)	(2.49)	(3.33)	(3.32)	(3.35)	(3.34)
2007	-0.5197***	-0.0078***	-0.6085***	-0.0091***	-0.6177***	-0.0092***
	(-8.82)	(-8.64)	(-10.06)	(-9.80)	(-10.17)	(-9.90)
2008	-0.1427***	-0.0022***	-0.1628***	-0.0024***	-0.1628***	-0.0024***
	(-2.64)	(-2.63)	(-2.96)	(-2.96)	(-2.95)	(-2.95)
Nr. Observations	119,553		119,553		119,553	
Pseudo R2	0.129		0.138		0.143	
BIC	17,791		17,655		17,568	
AIC	17,520		17,345		17,248	

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. All models estimated using a logit estimator, where the dependent variable, default, is a binary variable related to credit overdue. The standard errors are robust and clustered at the firm level. t-statistics are presented in parentheses. The first column of each Model presents the estimated coefficients, while the second column shows the marginal effects. The marginal effects correspond to the average, assuming as baseline firms with credit lines and changes in the number of bank lending relationships. In all regressions a constant and business sector dummies were included.

Chapter 2

Structure of corporate funding

Abstract: Funding is crucial for firms to invest, but also to operate their daily business. Different types of debt have different characteristics and requirements for firms. This study identifies the main determinants of the composition of corporate funding. In addition to bank and trade credit, two major funding sources, we also include in the analysis tax liabilities and loans granted by shareholders or intra-group operations. The results suggest that some firms' characteristics, such as profitability, present a similar relationship across the alternative funding sources under analysis, while others show a heterogeneous relationship. The results also suggest the relevance of variables related to firms' activity and business risk in the funding structure, and their heterogeneity across firms.

JEL Classification: G21, G32

Keywords: Corporate funding structure, Bank credit, Trade credit, Shareholders loans, Tax liabilities

2.1 Introduction

Funding is crucial for firms to invest and to expand, but also to operate their daily business. Some firms rely more intensively on internal funds, while others rely mainly on external funding. What determines a firm's capital structure and the heterogeneity across firms are important topics for corporate finance, but also for the real economy. The level of corporate indebtedness of some countries, such as Portugal, and its implications for the economic recovery have often been discussed over the last years, especially during the most recent economic and financial crises.

The literature on corporate capital structure is vast. This literature explores the advantages and disadvantages of capital and debt for firms, driven by market frictions, conflict of interest between shareholders and managers, and tax benefits. The *trade-off* theory (in which leverage reflects the balance between debt's advantages and costs) and the *pecking order* theory (the hierarchy of funding sources) are two of the most discussed theories in this field. However, it is also important to look carefully at the composition of corporate debt. Indeed, even for firms that have relatively stable leverage ratios, a non-negligible share of these firms may change the composition of their liabilities, as discussed by Rauh & Sufi (2010).

Different types of debt have different characteristics and requirements for firms. For instance, each type of debt has a distinct market function, different sensitivity to firm's information, and different payments schemes. Thus, it is also important to analyze firms' debt components. Along these lines, some studies explore the composition of firm's liabilities, as well as firm's access to financial markets. Due to their magnitude in total external funding in several countries, bank and trade credit are two debt components that have received extensive interest in the literature.

This study explores the composition of corporate debt. In addition to the analysis

of bank and trade credit, we also analyze debt components related to tax liabilities and shareholder or intra-group operations. Tax liabilities can be a relevant component for liquidity and working capital management. In turn, loans granted by shareholders or intra-group operations raise several important issues due to their nature, *i.e.* firm's owners provide funds to firms thought debt instruments rather than own equity. The purpose of this study is to identify the main determinants of bank and trade credit, but also of tax liabilities and shareholder or intra-group loans.

This study contributes to the empirical literature on corporate funding as it explores different debt components that have different characteristics, thereby possibly exposing firms to different shocks. Moreover, a particular contribution is related to the analysis of some debt components that are not usually documented in the literature of corporate funding or liquidity management, namely loans from shareholders or intra-group operations and tax liabilities. In order to perform the analysis we use a unique and detailed micro database for Portuguese firms, namely the Central Balance Sheet Database, which covers virtually the entire Portuguese corporate sector. Thus, this study explores a large set of non-public firms, dominated by small and medium sized enterprises, which are important segments for economic activity and employment in several countries. These firms are also more dependent on the funding components under analysis, as the access to financial public debt markets is limited (usually available to larger firms).

According to the results obtained, firms' profitability is negatively related to all of the funding sources included in the analysis. Variables related to the activity of firms also play a role in determining the funding sources. Furthermore, a firm's business risk seems to be an important feature, especially for tax liabilities and shareholder or intra-group loans.

The remainder of this Chapter proceeds as follows: Section 2.2 briefly reviews part of the literature on corporate funding. Section 2.3 describes the data sources and presents some descriptive statistics. Section 2.4 presents the econometric approach. Section 2.5 shows the empirical results, while Section 2.6 explores heterogeneity across firms. Section 2.7 presents some robustness tests. Finally, Section 2.8 concludes.

2.2 Related literature

According to Modigliani & Miller (1958), under some assumptions, notably in the absence of taxes, a firm's capital structure (equity *versus* debt) is irrelevant in determining its value. However, as discussed in Modigliani & Miller (1963), the existence of corporate taxes and the possibility of recognizing interest payments as a cost (creating tax shields) change considerably the earlier Modigliani and Miller's paradigm (*i.e.* the *Capital structure irrelevance proposition*). The authors showed there are some benefits for firms by holding debt, but holding debt also has costs, such as the costs associated with financial distress.

Following these seminal papers, there was a considerable increase of research (both theoretical and empirical) on capital structure. Most of the empirical research has focused on testing the implications of two main views of capital structure: the *trade-off* theory and the *pecking order* theory (Myers (1984) and Myers & Majluf (1984)). According to the former, firms have targets for the leverage ratios that balance several debt costs (*e.g.* financial distress costs, such as explored in Kraus & Litzenberger (1973), or the stockholders-bondholders agency conflicts, as discussed in Jensen & Meckling (1976)) and debt benefits (*e.g.* tax shields or mitigating manager-shareholder agency costs). According to the *pecking order* theory, firms

follow an optimal financing hierarchy in order to minimize adverse selection costs due to market imperfections in financial/credit markets. Under this theory, firms first use internal funds, then use debt, and issue equity only once their debt capacity is exhausted. Even though these theories identified relevant facts related to firm's capital structure, some unexplained empirical facts remain. For instance, neither of these theories is able to explain the diversity observed in debt structure of firms. More recently, other theories have been added that complement this field, seeking to introduce alternative explanations for firm's capital structure decisions, such as the *dynamic trade-off* theory (related to adjustment costs or endogenous investment), and the *equity market timing* theory.[1]

Understanding firms' choices between internal and external funding is an important issue. However, it is also important to look carefully at the composition of corporate debt. Indeed, even within firms that have relatively stable leverage ratios, a non-negligible share of firms also present changes in the composition of their liabilities, as shown in Rauh & Sufi (2010).

Looking at financial debt, empirical studies such as Barclay & Smith (1995), Gomes & Phillips (2012), Houston & James (1996), Houston & James (2001), Johnson (1997), Cantillo & Wright (2000), and Hadlock & James (2002) investigate the relationship between the use of public or private debt (for instance, wholesale debt market or bank credit, respectively) and firms' characteristics. In general, these studies confirm the positive relationship between public debt and some firms' characteristics such as size, leverage, age, and the amount issued. Denis & Mihov (2003) also analyzed the differences between debt types, exploring the determinants of new debt issues.[2] They found that one of the main determinants is a firm's credit quality. Their results suggest that firms with the highest credit quality obtain credit

[1] Frank M, Goyal V. (2008) and Graham & Leary (2011) present a survey of the literature on capital structure.

[2] The authors explored profitability, probability of default (based on Altman's Z-score), and credit rating variables as proxies for firms' "project and credit quality".

in financial markets, firms with medium credit quality obtain funding from banks, while firms with the lowest credit quality borrow from non-bank private lenders.

More recently, Rauh & Sufi (2010) adopted a different perspective in analyzing capital structure decisions and debt components. They found that the standard correlation between determinants and leverage ratios can be quite different depending upon the debt instrument under analysis. Moreover, they show that the reliance on several debt instruments depends on the firm's credit quality. Colla et al. (2013) extended the data set used by Rauh & Sufi (2010) by including unrated public firms. Unlike Rauh & Sufi (2010), in this data set they found a tendency toward debt specialization, *i.e.* the concentration in one type of debt. Despite the differences in their findings (related to the data set), both studies highlight that a deeper look into debt components would reveal relevant information about corporate funding.

Due to the importance of bank credit as an external funding source to firms, as many firms do not have access to the wholesale debt markets in several countries, an important avenue of research explores bank debt and, in particular, the bank lending relationships. This literature is quite extensive and suggests an impact of these relationships on firms' access to external finance and on contract conditions. According to the literature, firm-bank relationships play a critical role in mitigating asymmetric information, which is especially important for smaller and younger firms. The literature suggests that a borrower should benefit from few and longer bank lending relationships. However, the empirical results on this topic are mixed.[3] Actually, many firms have more than a single bank lending relationship. The number of lending relationships may be influenced by several factors: for both firms and banks there is a trade-off between the benefits of a closer lending relationship

[3]For instance, an increase in the number of lending relationships decreases the amount of credit (Petersen & Rajan (1994), Cole (1998) and Harhoff & Korting (1998)), while longer relationships increase the availability of credit (Petersen & Rajan (1994) and Harhoff & Korting (1998)), and decrease collateral requirements (Harhoff & Korting (1998) and Berger & Udell (1995)). However, regarding interest rates, the empirical evidence is mixed (*e.g.* Berger & Udell (1995), Houston & James (1996), Petersen & Rajan (1994), and Bonfim et al. (2008)).

and the benefits of a broader diversification of lenders/borrowers, such as the firm's hold-up problems, market competition or banks' portfolio diversification (*e.g.* Carletti et al. (2007)). The relationship between the number of credit relationships and a firm's credit quality has also been investigated, but the arguments in this topic are divergent (*e.g.* Degryse & Ongena (2001), Farinha & Santos (2002), and Fok et al. (2004)).

Beyond financial debt markets and bank credit, there is some literature looking into other funding sources, namely non-financial funding such as trade credit. This is motivated by the fact that trade credit is widely used and represents an important funding component for several firms. In the traditional perspective, trade credit plays a non-financial role for firms, such as the reduction of transaction costs, price discrimination, warranty of product quality, or fostering relationships with customers (*e.g.* Ferris (1981), Petersen & Rajan (1997)). Financial literature has complemented this analysis, showing that trade credit also plays a role as a funding source for firms. One of the main questions under discussion is the relationship between trade credit and other funding sources (perceived as cheaper), especially bank credit. The predominant idea is that firms use trade credit because they are bank credit constraints, *i.e.* firms use alternative forms of credit before trade credit (*e.g.* Petersen & Rajan (1994), Nilsen (2002), Cuñat (2007), and Atanasova & Wilson (2004)). Nevertheless, according to Biais & Gollier (1997), Burkart & Ellingsen (2004), and Fabbri & Menichini (2010) trade credit can also play a role as a complement to bank credit. A firm's suppliers may have a comparative advantage over financial institutions in collecting information, assessing the firm's creditworthiness, and monitoring its decisions. Thus, due to suppliers' ability to discriminate between "good" and "bad" firms, trade credit may be also a signal about a firm's credit quality (as already identified in Schwartz (1974)).

This study explores the differences of funding components, as highlighted in Rauh

& Sufi (2010) and Colla et al. (2013). However, while they focus on financial debt instruments, we analyze firms' liabilities in a broader perspective. Hence, the analysis presented in this Chapter is related to the literature that explores bank and trade credit, two of the main components of a firm's liabilities, but it explores additional debt components, namely tax liabilities and loans granted by shareholders or intra-group operations. To the best of our knowledge, these debt components are not well documented in the empirical literature of corporate funding.

Tax liabilities may be related to the possibility that firms exploit the payment schedule of these liabilities, *e.g.* allowing firms to overcome/manage liquidity needs. In turn, shareholder or intra-group loans are a topic that raises several questions, given the holders of these loans and the relationship with own equity. Depending on the contracts, these loans can be perceived as capital by the other debt holders. Indeed, in some jurisdictions, these loans are treated as capital when insolvency events occur. Moreover, there are also some specificities in the remuneration of these loans that may contribute to their attractiveness to firms. For firms, the interest paid on these loans, under some circumstances, can be treated as a cost. Thus, these loans may generate some benefits for firms. Furthermore, since in Europe equity decreases are seriously constrained, shareholder loans or intra-group operations are a more flexible way to finance firms than equity. The reimbursement of these loans is limited by covenants and terms defined in debt contracts instead of the general equity law. Additionally, from the shareholders' perspective, there may also exist some heterogeneous fiscal treatment on income earned by interests or dividends (loans *versus* capital remuneration). This too may have an impact on shareholders' incentives between the two options to "invest" in firms.

2.3 Data and variables

2.3.1 Data sources

The main data source used in this analysis is the annual information from the Central Balance Sheet Database (CB) for the Portuguese corporate sector, available at Banco de Portugal. The CB contains information from the financial statements, and some additional firm characteristics, such as the industry sector and the start-up date. Since 2006 the annual CB has been based on the Simplified Corporate Information (*Informação Empresarial Simplificada* - IES) instead of on a voluntary survey.[4] In order to use IES, which has almost universal coverage of the Portuguese corporate sector, the sample period begins in 2006 and goes up to 2012.

It is noteworthy that in 2010 there were some changes that affected the use of IES. On one hand, there was a change in the accounting rules. On the other, a new template was implemented. These events required adjustments in the information available in IES. Against this background, some variables should be interpreted with special care given the need to reconcile the two reports and establish a link between the two accounting schemes.[5]

In part of the analysis performed in this study, we complement the IES data with the information available at the Central Credit Register (CRC). The CRC contains data on credit granted by financial institutions operating in Portugal for contracts above 50 euros. This database includes the total outstanding amount of

[4] IES is an electronic submission of information of accounting, fiscal, and statistical nature that firms usually have to submit to several Portuguese authorities, namely Ministry of Justice, Ministry of Finance, Statistics of Portugal, and Banco de Portugal. Thus, instead of firms submitting nearly the same information to the different public entities, at different moments in time and different reports, as occurred before 2006, with IES firms do it once through the electronic system. As all firms have to submit the report, IES allows a high coverage of the Portuguese corporate sector by the Central Balance Sheet Database of Banco de Portugal.

[5] This topic will be explored in more detail whenever relevant in the following sections.

loans, and unused credit lines among other components.[6] CRC is mandatory and is reported on a monthly basis to Banco de Portugal. This database also allows matching firm-banks at each moment in time.

We impose some criteria in the definition of the data set. First, the financial sector and public administrations were excluded, as well as observations with misreported data for total assets, business volume, number of employees, or age. Moreover, firms with fewer than five employees were also ruled out. In addition, in order to remove outliers, we winsorize the variables at the top and bottom two per cent levels of their distribution.

After these steps, the data set comprises more than 655,000 observations, which corresponds to an unbalanced panel covering the period 2006 to 2012 and around 147,000 firms.[7]

2.3.2 Descriptive statistics

Table 2.1 displays some descriptive statistics on the capital structure and debt composition for firms included in the data set. Table 2.2 presents the mean and median figures of the distribution of these variables in each year.

At the aggregate level, Table 2.1, bank debt is the main external funding source for firms included in the data set. Despite this fact, a considerable share of firms in the sample does not have any bank linkage (around 30 per cent). For Portuguese firms, bank credit corresponds to the main component of financial debt. Debt securities represent a small fraction of financial debt, given that few firms have access to the

[6]For further details on the CRC and IES databases, see Booklet Nr.5 of Banco de Portugal (Banco de Portugal (2011*a*)), and Supplement of Statistical Bulletin (Banco de Portugal (2008)), respectively.

[7]However, due to lack of available data for some variables under analysis for all observations, the econometric analysis performed in next sections may include a smaller set of firms.

wholesale debt market. Therefore, in this analysis, debt securities are included in the component "other funding", the omitted category in the analysis. The two other sizable categories in firms' funding structures are trade credit and shareholder or intra-group loans. Tax liabilities amount to a smaller fraction of funding, but all firms use or manage the payment schedule of these liabilities.

When we observe the figures related to the distribution of these variables in the sample, Table 2.2, there are notable differences. Total indebtedness levels are higher, in terms of both the mean and the median figures. This means that several smaller firms have higher leverage ratios than larger firms. The structure of funding sources is also different between aggregate figures and the respective distribution. The share of trade credit increases significantly, while the bank credit decreases. Shareholder or intra-group loans also increase considerably in the first years of the sample period, but decrease thereafter. However this break should be interpreted carefully, since it may be related to the changes in the accounting schemes and IES's reports introduced in 2010. Note that these events seem to affect the share of bank credit too, but to a lesser extent.[8]

The results of the two approaches highlight the importance of complementing the analysis of the corporate sector at aggregate level with additional analysis based on microdata, due to the significant differences in firms' funding structure.

Table 2.3 presents some summary statistics looking at the funding structure by firms' size and age.[9] The empirical literature suggests that there are differences in

[8]The effect of the changes introduced in 2010 were not so evident at the aggregate level (*i.e.* with weighted figures). The impact of these events are taken into account in the analysis presented in the next sections. Moreover, it should be mentioned that the change in accounting schemes and reports avoids the distinction between loans from shareholders and loans from firms in the same economic group (defined as "intra-group operations" in this analysis), which was possible for the period before 2010.

[9]Firms' size is defined according to the European Commission Recommendation of 6 May 2003 (2003/361/EC). Thus, micro firms are defined as those with fewer than 10 employees and less than 2 million euro of business volume or total assets; small firms are those with fewer than 50 employees and less than 10 million euro of business volume or total assets; medium firms are those

the access to external finance based on firm size and age, which are usually proxies for asymmetric information, information opaqueness, and the firm's credit quality (for instance, as discussed in Carey et al. (1993), and Denis & Mihov (2003)).

By firm size, we observe that larger firms are more capitalized. Looking at the external funding sources, bank credit is more important for small and medium sized firms, while the share of trade credit is relatively stable across cohorts. Tax liabilities and loans from shareholders or intra-group operations are especially important in the funding structure of micro and small firms.

By firm age, we see that younger firms are relatively less capitalized. They also present differences in their debt structure, with higher shares of tax liabilities and loans from shareholders or intra-group operations than the other firms.

Table 2.1: Funding sources at the aggregate level - Weighted average

	Nr. of firms	Equity	Total Funding	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group
2006	100,355	0.303	0.598	0.188	0.138	0.027	0.078
2007	102,375	0.303	0.596	0.179	0.132	0.024	0.090
2008	100,662	0.283	0.617	0.194	0.129	0.020	0.095
2009	94,743	0.286	0.605	0.189	0.124	0.021	0.101
2010	93,620	0.301	0.645	0.200	0.124	0.019	0.113
2011	86,148	0.293	0.655	0.181	0.123	0.017	0.141
2012	77,283	0.287	0.661	0.168	0.114	0.018	0.148
Share of observations with positive values		0.86	1.00	0.69	0.94	1.00	0.41

Note: All the variables are scaled by total assets and defined at book value. Total funding corresponds to the ratio of total debt (excluding Accruals and deferrals, and provisions) over total assets. Thus, Total funding and Equity, as presented, are not complements, *i.e.* the sum of the two variables may be different from one.

As far as firm characteristics are concerned, we start the analysis by exploring the standard variables discussed in the capital structure literature, *i.e.* variables related to internal funding, agency costs, bankruptcy costs, and asymmetric information.

with fewer than 250 employees and a business volume below 50 million euros or whose total assets is lower than 43 million euros. The remaining firms are considered large firms.

Table 2.2: Funding sources - Distribution in the dataset

	Nr. of firms	Equity	Total Funding	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group
2006	100,355	0.238	0.722	0.128	0.208	0.083	0.112
		0.226	*0.710*	*0.045*	*0.156*	*0.040*	*0.002*
2007	102,373	0.226	0.717	0.133	0.205	0.077	0.107
		0.243	*0.703*	*0.051*	*0.152*	*0.036*	*0.001*
2008	100,660	0.227	0.715	0.139	0.199	0.073	0.106
		0.247	*0.697*	*0.055*	*0.145*	*0.034*	*0.000*
2009	94,741	0.237	0.705	0.150	0.191	0.070	0.102
		0.259	*0.686*	*0.076*	*0.137*	*0.033*	*0.000*
2010	93,620	0.236	0.747	0.198	0.195	0.071	0.040
		0.268	*0.717*	*0.137*	*0.140*	*0.033*	*0.000*
2011	86,148	0.241	0.744	0.184	0.190	0.070	0.058
		0.283	*0.702*	*0.118*	*0.135*	*0.032*	*0.000*
2012	77,283	0.245	0.739	0.174	0.188	0.072	0.062
		0.300	*0.685*	*0.104*	*0.132*	*0.033*	*0.000*

Note: All the variables are scaled by total assets and defined at book value. Total funding corresponds to the ratio of total debt, excluding (excluding accruals and deferrals, and provisions) over total assets. Thus, Total funding and Equity, as presented, are not complements, *i.e.* the sum of the two variables may be different from one. In each year, the first row shows the mean figures, while the second row shows the median figures (in *italics*).

Thus, in line with Rajan & Zingales (1995) for instance, we consider profitability, growth opportunities, tangibility, and size.

Profitability (PROFITABILITY) is defined as net earnings before provisions and depreciations over total assets. It thus measures firm's internal generation of funds. Sales growth (SALES GROWTH) is the year-on-year change of real sales, and it controls for the firm's growth opportunities.[10] Tangibility (TANGIBILITY) corresponds to the share of tangible assets over total assets, and is used to control for assets that a firm can pledge as collateral in credit operations, which contributes to a decrease in agency costs. These assets should retain more value in case of liquidation and thus they also contribute to a decrease in bankruptcy costs. Moreover, tangibility gives some insights about the assets structure of each firm. Firm's size (SIZE) is included in the analysis as the logarithm of total real assets. Size is usually related

[10]Firm's growth opportunities are usually controlled in the literature through measures related with firm's market value. However, this approach is not suitable to the Portuguese case, given the small share of quoted firms.

Table 2.3: Funding sources by firm size and age

Panel A - Firm size

	Micro		Small		Medium		Large	
	mean	*median*	*mean*	*median*	*mean*	*median*	*mean*	*median*
Total funding	0.76	0.72	0.70	0.69	0.65	0.65	0.61	0.61
Equity	0.21	0.25	0.26	0.27	0.28	0.29	0.29	0.30
Bank credit	0.14	0.05	0.17	0.11	0.19	0.15	0.14	0.05
Trade credit	0.19	0.13	0.20	0.16	0.20	0.16	0.18	0.14
Tax liabilities	0.08	0.04	0.07	0.03	0.06	0.02	0.05	0.02
Shareholder & Intra Group	0.11	0.00	0.07	0.00	0.05	0.00	0.07	0.00
Share of each class	52.39		40.35		6.19		1.07	

Panel B - Firm age

	Class 1		Class 2		Class 3		Class 4	
	mean	*median*	*mean*	*median*	*mean*	*median*	*mean*	*median*
Total funding	0.85	0.81	0.74	0.72	0.67	0.66	0.63	0.60
Equity	0.10	0.15	0.22	0.24	0.29	0.31	0.33	0.37
Bank credit	0.15	0.05	0.16	0.09	0.16	0.10	0.15	0.08
Trade credit	0.22	0.16	0.20	0.15	0.19	0.14	0.17	0.13
Tax liabilities	0.10	0.05	0.07	0.04	0.06	0.03	0.06	0.03
Shareholder & Intra Group	0.10	0.00	0.08	0.00	0.08	0.00	0.08	0.00
Share of each class	26.59		25.03		24.31		24.07	

Note: All the variables are scaled by total assets and defined at book value. Total funding corresponds to the ratio of total debt, defined as total liabilities (excluding accruals and deferrals, and provisions) over total assets. Thus, Total funding and Equity, as presented, are not complements. Firm age classes were defined based on the quartiles of the distribution. Class 1: age $\leq$ 6 years; Class 2: 6< age $\leq$ 12 years; Class 3: 12 < age $\leq$ 21 years; Class 4: age>21 years.

to asymmetric information and the firm's credit quality. In the same line, age (AGE) is also included: older firms have established track records that lenders can evaluate. Additionally, age is also related to the firm's life cycle: financial needs are usually higher in the initial years of firms.

As we intend to investigate corporate funding in more detail, instead of the total leverage ratio, it is also important to control for additional factors that can be underlying the use of different funding sources by firms (and thereby minimize potential "omitted variable bias"). As some of funding sources considered are related to a firm's activity, variables related to this dimension are also explored. Therefore, we include variables directly related to firm's operational activity and working capital. Namely, we also look into the share of inventories over assets, (INVENTORIES), credit granted to customers (ACCOUNTS RECEIVABLE), and the turnover ratio (TURNOVER). A measure related to the business risk of firms is also included, using as proxy the volatility of the cashflow ratio (SD CASHFLOW).

Following the bank lending relationship literature, and the effect of those relationships on firm's access to funding, some variables related with firm-bank lending relationships are also investigated. We include as explanatory variables the number of banking relationships, defined at the banking group level, and taking into account the weight of each banking group on the firm's total bank debt (BANKING RELATIONSHIP), as well as the duration of the longest banking relationship (LENGTH BANKREL). The availability of unused credit lines (CREDIT LINE) is also considered.

Finally, the set of firm characteristics includes a dummy variable that controls if the firm belongs to an economic group (EC. GROUP). The inclusion of this control variable is motivated by the fact that the balance sheet data are not reported on a consolidated basis. This implies that the share of some funding sources may be affected by funds transactions at the group level.[11]

[11]For instance, a firm can borrow from the banking system and provide the loan to another firm

Table 2.4 has some summary descriptive statistics of these firms' variables in the data set. Table II.1 in the Appendices Section of this Chapter briefly summarizes all variables. Table II.2 presents the correlation matrix.

Table 2.4: Summary statistics - Firm characteristics

	Nr.	**mean**	**sd**	**p10**	**p25**	**p50**	**p75**	**p90**
PROFITABILITY	655,187	0.04	0.17	-0.11	0.01	0.05	0.11	0.20
SALES GROWTH	568,450	-0.03	0.32	-0.38	-0.16	-0.02	0.11	0.30
TANGIBILITY	655,187	0.27	0.24	0.02	0.07	0.20	0.41	0.64
SIZE	655,149	13.07	1.57	11.23	12.02	12.95	13.97	15.07
AGE	655,187	2.49	0.84	1.39	1.95	2.56	3.09	3.50
ASSET TURNOVER	655,187	1.48	1.20	0.38	0.70	1.16	1.86	2.93
INVENTORIES	655,187	0.18	0.23	0.00	0.00	0.09	0.28	0.54
ACCOUNTS RECEIVABLE	655,187	0.25	0.23	0.00	0.02	0.20	0.42	0.60
CASHFLOW VOLATILITY	638,929	0.11	0.14	0.02	0.03	0.06	0.12	0.25
BANKING RELATIONSHIP	655,187	0.60	0.36	0.00	0.34	0.59	1.00	1.00
LENGTH BANKREL.	655,187	1.61	0.95	0.00	1.10	1.95	2.40	2.56
CREDIT LINE	655,187	0.59	0.49	0.00	0.00	1.00	1.00	1.00

Note: sd stands for standard deviation. p10, p25, p50, p75, and p90 stand for, respectively, the percentiles 10, 25, 50, 75, and 90 of the distribution of each variable.

2.4 Econometric approach

2.4.1 Empirical specification

As mentioned above, we are interested in analyzing firms' funding sources, namely bank credit, trade credit, loans granted by shareholders or intra-group operations, and tax liabilities. The econometric analysis is based on seemingly unrelated regressions (SUR), as a firm's alternative funding sources may be related. Therefore, each

that belongs to same economic group. In this case, for the latter firm, the share of bank credit would be underestimated.

equation in the system has the following specification:

$$\frac{Funding^{j}_{i,t}}{Asset_{i,t}} = c + \beta X_{i,t-1} + \delta z_i + \varphi w_t + \mu^{j}_{i,t} \tag{2.1}$$

where j stands for each funding source under analysis, i is the firm's identification, and t corresponds to the time dimension. Therefore, the dependent variable corresponds to funding source j of firm i in period t, scaled by total assets. $X_{i,t-1}$ is a vector of firm i time-varying variables, which may affect the firm's debt components, evaluated at $t-1$. Additionally, z_i and w_t correspond to industry sector and time effects, respectively. The industry sector dummies control for differences in the market in which the firm operates, while time effects, represented by year dummies, control for changes that affect all firms simultaneously. Finally, $\mu^{j}_{i,t}$ corresponds to the error term of each equation.

The SUR approach estimates the four equations simultaneously and takes into account the possible relationship between the error terms of each equation. Moreover, due to the specificities of the data set, in the regression set up, the standard errors are robust and clustered at the firm level, controlling for the heteroscedasticity issues and the longitudinal dimension at firm level.

2.5 Determinants of firms funding sources

2.5.1 Capital structure variables

As a starting point for the econometric analysis, the choice of the firm characteristics included as explanatory variables is motivated by the capital structure literature. As such, the specifications include variables related to profitability, sales growth, size, and tangibility. Firm's age is also included as it is a proxy for firm's information

opaqueness and life cycle. Additionally, the specifications include a dummy variable that controls if a firm belongs to an economic group.

Table 2.5 contains the results under the SUR approach.[12] Model 1 includes the above mentioned firm characteristics only as regressors. An overview of the results allows us to conclude that these variables are broadly statistically significant. Moreover, we also observe that some variables show a heterogeneous impact across the funding sources under analysis.

PROFITABILITY has a negative coefficient in all equations, suggesting that firms with more internal funds use less external funding than other firms, which is in line with some findings in the literature (*e.g.* Fama & French (2002), Frank & Goyal (2003), and Antão & Bonfim (2012)). The comparison of the coefficients across the funding sources allows us to observe that profitability seems to have a greater impact on the trade credit component. The negative relationship between internal funds and external funding is usually presented as evidence supporting the *pecking order* theory (*i.e.* due to asymmetric information, firms use internal funds before external funding sources), in opposition to the *trade-off* theory. Following the latter theory, profitability should be positively related with leverage, as it helps to decrease the bankruptcy costs and allows tax shields.[13]

SIZE is always statistically significant, but has a heterogeneous impact on funding sources: a positive coefficient in bank and trade credit and the opposite sign in the remaining funding sources. The positive sign for bank and trade credit should be related to asymmetric information and firm's credit quality. Indeed, larger firms

[12] As the set of regressors is the same in the four equations in the system, the coefficients estimated under the SUR approach coincide with those estimated with Ordinary Least Squares (OLS). However, as the SUR controls for the correlation between the residuals of the equations included in the system, the t-statistics and consequently the significance of the coefficients can be different under the two econometric approaches.

[13] Nevertheless, as described in Section 2.2, a recent research avenue in this field presents alternative explanations for the negative coefficient of profitability that are not necessarily in contradiction to the *trade-off* theory.

tend to have more information available and usually have higher credit quality, as they are usually more diversified (as discussed in Fama & French (2002) and Frank & Goyal (2003)). Therefore, the access to financial debt, in particular bank credit, should be easier for these firms (which is in line with the positive coefficient). A possible reason underlying the positive relationship between size and trade credit is that larger firms may have more offers of credit from their suppliers, as they are usually firms with high credit quality. Moreover, large firms may also have some bargaining power with suppliers and, consequently, negotiate better contract conditions (which may be reflected, for instance, in higher credit amounts and/or longer periods to repay the credit). In this line, Klapper et al. (2012) found that smaller firms provide trade credit to larger firms with lengthy maturity. Indeed, a limitation of using accounts payable, obtained in balance sheet, as a measure of trade credit is that it is not possible to distinguish between transactional and financing purposes, nor is it possible to identify the supplier, and consequently establish trade credit chains.

TANGIBILITY also shows a heterogeneous impact on the different funding sources. This variable allows us to assess the share of assets that can be pledged as collateral in credit contracts. For bank credit, as expected, the coefficient is positive (*e.g.* in line with Rauh & Sufi (2010)). Tangibility also has a positive coefficient for shareholder or intra-group loans. For trade credit and tax liabilities, the coefficient is negative. The highest impact is recorded on bank credit equation. This result is in line with the idea that fixed assets should be financed with longer-term funding and also support the role of collateral in mitigating information asymmetries.

AGE has a negative coefficient in all equations except shareholder loans or intra-group operations. Older firms appear to be less indebted than younger ones, for some specific debt components. These results may be related to a firm's life cycle, as firms tend to have higher financial needs in the beginning of their activity (*e.g.*

they have lower levels of accumulated capital, and higher investment needs).

Model 2, in the same table, presents the results for the specification including time dummies also as explanatory variables. The time dummies capture differences that affect all the firms simultaneously, such as macroeconomic and financial developments. The inclusion of these variables in the analysis is crucial, given that the sample period includes different phases of the economic business cycle: years of economic activity growth and years of severe economic recession. Moreover, the time dummies also allow us to control the impact of the changes recorded in IES' reports and accounting schemes mentioned above that took place in 2010 and affected all firms.

The results obtained in this specification are broadly the same. The main change occurs in SALES GROWTH. In this specification, when statistically significant, it has a positive coefficient. This result may signal some financial needs, since sales growth should be related to a firm's growth opportunity. However, the economic impact is relatively small (based on standard-deviation changes).

Looking at the time dummies variables, in the bank credit equation, the results suggest that there was an increase in the average share of this funding up to 2009/2010 (taking 2007 as reference), and thereafter fell slightly. For trade credit the coefficients are negative, but for the last years of the sample period they suggest a relative stability. For tax labilities the coefficients are always negative, but with smaller magnitudes. The effects of changes in the accounting schemes and IES's templates seem to be underlying the shareholder or intra-group loans, which were the funding sources that had the highest series break, looking at the descriptive statistics.

Finally, Model 3 presents the results with the inclusion of business dummies in the specification. The literature emphasizes the importance of controlling for the

business sector of firms, in particular in the analysis of funding issues (*e.g.* Fisman & Love (2003), and Fabbri & Menichini (2010)). For simplicity, the coefficients of these variables are not reported in the table. In general, the conclusions described above continue to hold.

All in all, the results highlight the heterogeneous impact of some firms' characteristics on different funding sources. The exception is profitability, which presents negative relationships with all of the funding sources under analysis. Profitability is also within the variables with higher economic impact across the different funding sources (assessed by standard-deviation changes).

The econometric results obtained afford us some first insights on the relations between some key firm characteristics and debt composition, which may contribute to a better understanding of corporate funding.

Table 2.5: Capital structure standard regressors

	Model 1				Model 2				Model 3			
	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group
PROFITABILITYt-1	-0.1986***	-0.2584***	-0.1254***	-0.2076***	-0.1933***	-0.2607***	-0.1257***	-0.2175***	-0.1913***	-0.2464***	-0.1310***	-0.2124***
	(-98.93)	(-133.81)	(-116.37)	(-119.85)	(-96.89)	(-134.81)	(-116.48)	(-127.97)	(-95.42)	(-130.68)	(-122.48)	(-124.46)
SALES GROWTHt-1	-0.0048***	0.0144***	0.0051***	0.0137***	0.0009	0.0139***	0.0051***	0.0051***	0.0004	0.0197***	0.0043***	0.0042***
	(-5.67)	(17.67)	(11.12)	(18.77)	(1.08)	(16.89)	(11.12)	(7.08)	(0.50)	(24.68)	(9.51)	(5.83)
SIZEt-1	0.0262***	0.0128***	-0.0208***	-0.0159***	0.0266***	0.0126***	-0.0209***	-0.0166***	0.0273***	0.0076***	-0.0195***	-0.0157***
	(136.68)	(69.34)	(-202.64)	(-95.97)	(140.24)	(68.69)	(-202.82)	(-102.57)	(137.44)	(40.81)	(-184.46)	(-92.95)
TANGIBILITYt-1	0.1617***	-0.1530***	-0.0325***	0.0427***	0.1613***	-0.1527***	-0.0324***	0.0430***	0.1716***	-0.1164***	-0.0452***	0.0326***
	(136.78)	(-134.56)	(-51.26)	(41.90)	(137.62)	(-134.43)	(-51.10)	(43.08)	(134.31)	(-96.90)	(-66.36)	(30.00)
AGE	-0.0218***	-0.0365***	-0.0106***	0.0017***	-0.0214***	-0.0366***	-0.0107***	0.0018***	-0.0196***	-0.0384***	-0.0119***	0.0010***
	(-50.27)	(-87.37)	(-45.40)	(4.63)	(-49.69)	(-87.51)	(-45.99)	(4.92)	(-44.66)	(-93.15)	(-50.73)	(2.70)
2008					0.0054***	-0.0072***	-0.0052***	0.0003	0.0054***	-0.0065***	-0.0050***	0.0001
					(5.70)	(-7.76)	(-10.01)	(0.31)	(5.69)	(-7.32)	(-9.92)	(0.11)
2009					0.0145***	-0.0166***	-0.0084***	-0.0042***	0.0146***	-0.0152***	-0.0085***	-0.0044***
					(15.20)	(-17.93)	(-16.23)	(-5.19)	(15.24)	(-16.91)	(-16.60)	(-5.40)
2010					0.0637***	-0.0112***	-0.0071***	-0.0702***	0.0637***	-0.0091***	-0.0072***	-0.0704***
					(66.11)	(-12.04)	(-13.58)	(-85.51)	(66.26)	(-10.10)	(-14.01)	(-85.99)
2011					0.0509***	-0.0166***	-0.0069***	-0.0640***	0.0511***	-0.0145***	-0.0072***	-0.0641***
					(52.21)	(-17.60)	(-13.15)	(-77.11)	(52.58)	(-15.89)	(-13.83)	(-77.43)
2012					0.0386***	-0.0183***	-0.0049***	-0.0644***	0.0391***	-0.0152***	-0.0054***	-0.0645***
					(38.84)	(-19.02)	(-9.04)	(-76.12)	(39.48)	(-16.26)	(-10.29)	(-76.40)
Ec. Group	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Business sector	no	no	no	no	no	no	no	no	yes	yes	yes	yes
Nr.	434,100				434,100				434,100			
R^2	0.093	0.096	0.145	0.122	0.108	0.097	0.145	0.159	0.112	0.153	0.0.172	0.163

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The results were obtained running a SUR, with robust standard errors and clustering at firm level. Firm's characteristics were included as regressors with a lag, with exception of the variable Age. All specifications included a constant term.

2.5.2 Delving deeper into firm activity

The previous analysis explored the key variables discussed in the capital structure literature. In order to look into the composition of funding in more detail, it may also be important to control for additional firm characteristics that can be influencing the use of the different funding sources. Therefore, we include in the analysis measures related to the firm's activity as explanatory variables, namely variables related to inventories, credit granted by firms to customers, and turnover. We also include a variable related to the business risk, given that this characteristic may affect the type of funding that the firm can obtain. The results of the new specification are presented in Table 2.6. Given the relevance of time and business dummies observed in the previous sub-section, only the estimates with these variables are presented.[14]

According to the results obtained, the new variables seem to contain additional information in the analysis of funding structure. INVENTORIES present positive and statistically significant coefficients, with the exception of tax liabilities, in which the coefficient is negative. This means that firms with a higher proportion of inventories have a higher share of bank credit, shareholder or intra-group loans, and trade credit. The higher impact occurs in the latter funding source: an increase of one standard-deviation implies an increase of 2.7 percentage points on trade credit. The variable ACCOUNTS RECEIVABLE also shows positive coefficients for the funding sources under analysis, with exception of tax liabilities. These results may be related to firms' intentions to adopt a suitable cash management policy, allowing for a better match between cash inflows and outflows. This relationship is especially important, as expected, for trade credit. An increase of one standard-deviation implies an increase by 4.7 percentage points. The impacts on the other funding sources are significantly lower.

[14]Nevertheless, for simplicity, the coefficients of these variables are not included in the tables.

The relevance of some indicators more directly related to firm's activity is in line with some qualitative evidence for Portuguese firms. For instance, according to the results of the Bank Lending Survey conducted in Portugal, inventories and working capital have been reported as an important driver underlying bank loan demand in the corporate segment.

TURNOVER, which captures the volume of a firm's activity, is also statistically significant. It has negative coefficients for bank credit and shareholder or intra-group loans and positive coefficients for trade credit and tax liabilities. These results seem to be in line with the argument that firms exploit payments schemes and "grace periods" provided by suppliers and tax regimes.

The proxy for the business risk shows positive coefficients in all equations, *i.e.* firms with higher volatility in their cash flows (SD CASHFLOW) tend to rely more on the funding sources under analysis rather than on the "omitted funding sources" in the equation system. Note that equity is a key component of this omitted category. The positive relationship suggests that firms with more unstable performances need more external resources to finance their activity. For bank credit, this result may be somewhat counterintuitive. Nevertheless, the results suggest that the ability of riskier firms to obtain bank credit seems to be lower in comparison to the other funding sources under analysis, given the significant difference in the magnitude of the coefficients. For riskier firms, tax liabilities seem to represent an important funding/liquidity management tool. Indeed, a one standard-deviation increase implies an increase by around 2 percentage points of these liabilities. Loans granted by shareholders or intra-group operations also seem to play an important role for riskier firms, even though to a lesser extent.

Regarding the other variables included in the specification, the results described in the previous sub-section remain broadly the same. Therefore, based on the results

Table 2.6: Additional regressors: Activity indicators

	Model 1			
	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group
PROFITABILITYt-1	-0.1573***	-0.2321***	-0.1089***	-0.1553***
	(-74.04)	(-120.01)	(-98.80)	(-86.54)
SALES GROWTHt-1	0.0023***	0.0052***	-0.0006	0.0068***
	(2.74)	(6.68)	(-1.26)	(9.52)
SIZEt-1	0.0262***	0.0156***	-0.0134***	-0.0162***
	(120.09)	(78.49)	(-118.49)	(-87.81)
TANGIBILITYt-1	0.1955***	-0.0101***	-0.0544***	0.0580***
	(132.72)	(-7.52)	(-71.21)	(46.66)
AGE	-0.0204***	-0.0359***	-0.0089***	0.0005
	(-46.59)	(-90.05)	(-39.30)	(1.25)
INVENTORIESt-1	0.0870***	0.1211***	-0.0583***	0.1052***
	(55.06)	(84.19)	(-71.17)	(78.82)
ACCOUNTS RECEIVABLEt-1	0.0204***	0.2013***	-0.0146***	0.0116***
	(13.24)	(143.40)	(-18.28)	(8.91)
TURNOVERt-1	-0.0060***	0.0281***	0.0057***	-0.0098***
	(-21.28)	(109.60)	(38.70)	(-41.05)
SD CASHFLOWt-1	0.0420***	0.0653***	0.1597***	0.1067***
	(17.65)	(30.17)	(129.48)	(53.11)
Ec. Group	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes
Business sector	yes	yes	yes	yes
Nr.	434,100			
R^2	0.120	0.215	0.226	0.185

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The results were obtained running a SUR, with robust standard errors and clustering at firm level. Firm's characteristics were included as regressors with a lag, with exception of the variable Age. All specifications included a constant term.

obtained, across the different funding sources under analysis, profitability and size are among the variables with greater impact. Nevertheless, for bank credit the main driver is tangibility (a one standard-deviation increase implies an increase of around 4.5 percentage points in these liabilities). For trade credit, accounts receivable should also be highlighted (4.7 percentage points). For loans from shareholders or intra group operations, inventories also show considerable impact (2.4 percentage points). For tax liabilities the main impact is related to the proxy for business risk (around 2.1 percentage points).

2.5.3 Banking lending relationships

Bank credit is the main financial funding source of Portuguese firms, and one of the main external funding sources, in general. Against this background, we ran some additional specifications with the purpose of investigating how the relationship between firms and banks may affect the funding sources under analysis. Thus, in line with the banking lending relationship literature, variables related to the number of banking relationships, their length, and the availability of credit lines are also included as regressors.

This analysis is conducted for a sub-sample of the data set analyzed previously, namely excluding from the sample firms without any linkage with the financial system. Model 1 in Table 2.7 shows the results of the specification presented in the previous sub-section for this sub-sample.[15] Model 2 presents the estimates for the specification with the new set of variables.

Based on Model 2, looking at bank credit we find a negative sign with the number of banking relationships. This result can be related to the arguments that the number of banking relationships may be a signal of a firm's credit quality: firms with lower credit quality tend to establish more bank relationships, in order to obtain additional funds (*e.g.* Degryse & Ongena (2001), and the empirical findings described in Chapter 1). In turn, we observe that the duration variable presents a positive coefficient (greater knowledge between borrowers and lenders), in line with the Petersen & Rajan (1994) and Harhoff & Korting (1998). Additionally, the availability of credit lines also has a positive impact on the share of bank credit.

For the other funding sources under analysis, we also find some correlations. In particular, firms with unused credit lines tend to present lower levels of the remaining funding sources. The number of banking relationships also presents negative

[15] In order to understand the impact on the results driven by the reduction of the sample.

coefficients, with the exception of loans from shareholders or intra-group operations. These findings support the argument that this variable may be related to firm's credit quality. Firms with longer lending relationships also present lower trade credit, and shareholder loans or intra-group operations. The negative relationship between the banking variables under analysis and trade credit might be evidence for the substitution effect between these two funding sources, as argued by some authors in the literature (*e.g.* Atanasova & Wilson (2004)). For tax liabilities the coefficient of lending relationship's duration is positive, but the magnitude is very low.

It is noteworthy that bank decisions (that are reflected in the set of bank relationships variables) may be influenced in some way by the other firm characteristics included in the analysis. Therefore, the analysis conducted in this sub-section allows to identify some possible relationships between funding sources and the banking variables, but it should be interpreted with due care.

Table 2.7: Banking lending relationships and credit quality

	Model 1				Model 2			
	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group
PROFITABILITYt-1	-0.2112***	-0.2512***	-0.1078***	-0.1529***	-0.2112***	-0.2515***	-0.1083***	-0.1530***
	(-84.78)	(-115.41)	(-89.71)	(-79.88)	(-87.39)	(-115.62)	(-90.31)	(-80.30)
SALES GROWTHt-1	0.0047***	0.0049***	-0.0014***	0.0064***	0.0138***	0.0065***	-0.0011**	0.0041***
	(5.09)	(6.12)	(-3.14)	(8.96)	(15.32)	(8.03)	(-2.52)	(5.82)
SIZEt-1	0.0188***	0.0131***	-0.0130***	-0.0143***	0.0066***	0.0116***	-0.0125***	-0.0106***
	(78.09)	(62.59)	(-112.52)	(-77.24)	(26.59)	(52.03)	(-101.48)	(-54.27)
TANGIBILITYt-1	0.1784***	-0.0210***	-0.0517***	0.0527***	0.1591***	-0.0240***	-0.0518***	0.0579***
	(108.14)	(-14.58)	(-64.93)	(41.53)	(98.96)	(-16.59)	(-64.91)	(45.64)
AGE	-0.0175***	-0.0349***	-0.0079***	-0.0005	-0.0387***	-0.0387***	-0.0087***	0.0046***
	(-35.78)	(-81.88)	(-33.48)	(-1.27)	(-73.29)	(-81.39)	(-33.11)	(11.05)
INVENTORIESt-1	0.0829***	0.1082***	-0.0575***	0.0978***	0.0669***	0.1059***	-0.0574***	0.1024***
	(46.74)	(69.79)	(-67.18)	(71.76)	(38.80)	(68.22)	(-67.01)	(75.26)
ACCOUNTS RECEIVABLEt-1	-0.0043**	0.2020***	-0.0163***	0.0100***	-0.0371***	0.1973***	-0.0161***	0.0195***
	(-2.46)	(133.95)	(-19.56)	(7.57)	(-21.95)	(129.80)	(-19.25)	(14.61)
TURNOVERt-1	-0.0060***	0.0308***	0.0052***	-0.0092***	-0.0069***	0.0308***	0.0056***	-0.0088***
	(-18.71)	(110.32)	(34.03)	(-37.36)	(-22.23)	(110.24)	(36.02)	(-35.88)
SD CASHFLOWt-1	0.0742***	0.0726***	0.1623***	0.1042***	0.0830***	0.0738***	0.1619***	0.1020***
	(26.78)	(29.97)	(121.42)	(48.94)	(30.85)	(30.47)	(121.17)	(48.08)
BANKING RELATIONSHIPt-1					-0.1219***	-0.0197***	-0.0070***	0.0380***
					(-116.64)	(-20.90)	(-13.41)	(46.15)
CREDIT LINEt-1					0.0223***	-0.0024***	-0.0121***	-0.0092***
					(31.11)	(-3.68)	(-33.94)	(-16.30)
LENGHT BANKREL.t-1					0.0456***	-0.0116***	0.0026***	-0.0105***
					(83.39)	(-13.35)	(9.63)	(-24.40)
Ec. Group	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes
Business sector	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	375,329				375,329			
R^2	0.113	0.224	0.213	0.175	0.165	0.225	0.216	0.182

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The results were obtained running a SUR, with robust standard errors and clustering at firm level. Firm's characteristics were included as regressors with a lag, with exception of the variable Age. All specifications included a constant term.

2.6 Heterogeneity by firm size

In this section we investigate if the determinants of the funding sources change for different groups of firms, based on firm's size. Thus, we run the first two sets of specifications presented in this Chapter for four size cohorts: micro, small, medium, and large firms.[16]

According to the results obtained, presented in Table 2.8, PROFITABILITY preserves the negative coefficient in all funding sources regardless of the cohorts in the analysis. However, the impact on the funding sources is heterogeneous across groups. For instance, for micro and small firms the greatest effect occurs in trade credit, while for medium and large firms the greatest effect occurs in bank credit equation. Looking at TANGIBILITY, the relationship recorded for the whole sample continues to hold, *i.e.* the coefficients are positive for bank credit and shareholder or intra-group loans and negative for the two other funding sources. The results for AGE are also in line with those of the full sample for micro and small firms: the coefficients are positive for shareholder or intra-group loans, while for the remaining funding components the signs are negative. For medium firms, the coefficients are all negative, while for large firms the coefficient is positive for bank credit. Broadly, these results are in line with asymmetric information hypothesis, and the higher capital level of older firms. In turn, there are differences concerning SIZE and SALES GROWTH variables in some funding sources, in comparison to the full sample.

Looking at the specifications with activity indicators, Table 2.9, INVENTORIES preserve, in general, the same relationship described for the whole sample. The coefficients are negative for tax liabilities and positive for the other funding sources. The exceptions are loans from shareholders or intra-group operations in medium firms

[16]Firm size defined according to the European Commission Recommendation 2003/361/EC, presented previously.

segments (not statistically significant), and for large firms (for which this variable presents a negative coefficient). The variable ACCOUNTS RECEIVABLE shows positive and statistically significant coefficients, regardless of firm size, for bank credit and for trade credit. The impact is quite strong for the latter funding source. For tax liabilities, when significant, the relationship is negative. Looking at shareholder or intra-group loans, the results are mixed. TURNOVER presents some heterogeneous impact. Consistently across size cohorts, it presents a positive relationship with trade credit (which is in line with firm's activity).

Finally, as far as business risk is concerned, SD CASHFLOW, the positive coefficient recorded for the whole sample in all of the funding sources under analysis remained for micro and smaller firms. For medium and larger firms, the coefficient of this variable is negative for bank credit, which is in line with what we would expect regarding firm's risk and the availability of external sources (especially bank credit).

Table 2.8: Capital structure standard regressors - by firm size

(Continues)

Panel A - Micro and Small firms

	Micro				Small			
	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra group	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra group
PROFITABILITYt-1	-0.1579***	-0.2423***	-0.1148***	-0.2244***	-0.2327***	-0.2539***	-0.1477***	-0.1987***
	(-55.94)	(-86.99)	(-77.08)	(-81.92)	(-67.83)	(-80.54)	(-82.19)	(-77.43)
SALES GROWTHt-1	-0.0007	0.0186***	0.0008	0.0101***	0.0014	0.0211***	0.0011*	0.0034***
	(-0.50)	(-13.84)	(-1.15)	(-7.61)	(-1.08)	(-17.5)	(-1.67)	(-3.47)
SIZEt-1	0.0356***	0.0050***	-0.0317***	-0.0126***	0.0337***	0.0073***	-0.0318***	-0.0118***
	(-82.26)	(-11.59)	(-138.73)	(-29.92)	(-88.53)	(-20.82)	(-159.38)	(-41.58)
TANGIBILITYt-1	0.1583***	-0.1142***	-0.0417***	0.0379***	0.1781***	-0.1214***	-0.0499***	0.0339***
	(-81.56)	(-59.64)	(-40.76)	(-20.11)	(-89.31)	(-66.27)	(-47.84)	(-22.73)
AGE	-0.0268***	-0.0427***	-0.0079***	0.0022***	-0.0193***	-0.0370***	-0.0144***	0.0022***
	(-39.49)	(-63.66)	(-22.17)	(-3.28)	(-28.30)	(-58.95)	(-40.27)	(-4.25)
Economic Group	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes
Business sector	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	179,350				179,008			
R^2	0.103	0.161	0.187	0.196	0.125	0.151	0.225	0.145

(Table 2.8 Continued)

Panel B - Medium and large firms

	Medium				Large			
	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra group	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra group
PROFITABILITYt-1	-0.2910***	-0.2344***	-0.1383***	-0.1569***	-0.4739***	-0.1933***	-0.0574***	-0.0857***
	(-30.28)	(-28.87)	(-31.81)	(-26.71)	(-19.97)	(-9.47)	(-6.40)	(-4.64)
SALES GROWTHt-1	0.0004	0.0244***	0.0033**	0.002	0.0169*	0.0012	0.0077**	0.0064
	(-0.12)	(-8.1)	(-2.07)	(-0.91)	(-1.9)	(-0.16)	(-2.28)	(-0.92)
SIZEt-1	0.0220***	-0.0043***	-0.0315***	0.0009	-0.001	-0.0103***	-0.0177***	0.0058***
	(-23.97)	(-5.59)	(-75.88)	(-1.58)	(-0.55)	(-6.27)	(-24.66)	(-3.94)
TANGIBILITYt-1	0.1709***	-0.1405***	-0.0245***	0.0198***	0.1713***	-0.0787***	-0.0203***	0.0512***
	(-33.5)	(-32.60)	(-10.62)	(-6.35)	(-14.21)	(-7.59)	(-4.46)	(-5.47)
AGE	-0.0113***	-0.0207***	-0.0091***	-0.0106***	0.0242***	-0.0285***	-0.0035**	-0.0122***
	(-6.76)	(-14.60)	(-12.03)	(-10.37)	(-6.75)	(-9.24)	(-2.57)	(-4.39)
Economic Group	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes
Business sector	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	27,924				4,907			
R^2	0.122	0.181	0.277	0.169	0.178	0.242	0.465	0.227

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively.. The t-statistics are in parentheses. The results were obtained running a SUR, with robust standard errors and clustering at firm level. Firm's characteristics were included as regressors with a lag, with exception of the variable Age. All specifications included a constant term.

Table 2.9: Additional regressors: Activity indicators - by firm size

(Continues)

Panel A - Micro and small firms

	Micro				Small			
	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra group	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra group
PROFITABILITYt-1	-0.1334***	-0.2201***	-0.0886***	-0.1593***	-0.1892***	-0.2513***	-0.1280***	-0.1484***
	(-44.15)	(-76.00)	(-56.73)	(-55.03)	(-52.61)	(-79.26)	(-69.22)	(-55.34)
SALES GROWTHt-1	-0.0022	0.0060***	-0.0012*	0.0125***	0.0022*	0.0064***	-0.0002	0.0048***
	(-1.57)	(4.60)	(-1.74)	(9.52)	(1.66)	(5.55)	(-0.28)	(4.91)
SIZEt-1	0.0387***	0.0218***	-0.0233***	-0.0173***	0.0311***	0.0227***	-0.0255***	-0.0134***
	(71.99)	(42.38)	(-83.80)	(-33.62)	(70.24)	(58.11)	(-111.79)	(-40.41)
TANGIBILITYt-1	0.1734***	-0.0162***	-0.0486***	0.0747***	0.2090***	-0.0035*	-0.0672***	0.0539***
	(77.61)	(-7.55)	(-42.14)	(34.91)	(90.63)	(-1.70)	(-56.69)	(31.35)
AGE	-0.0264***	-0.0393***	-0.0062***	0.0023***	-0.0208***	-0.0347***	-0.0113***	0.0020***
	(-38.77)	(-60.22)	(-17.78)	(3.53)	(-30.55)	(-57.63)	(-32.14)	(3.88)
INVENTORIESt-1	0.0398***	0.1170***	-0.0383***	0.1243***	0.1240***	0.1268***	-0.0679***	0.0843***
	(17.61)	(54.05)	(-32.83)	(57.41)	(47.60)	(55.21)	(-50.71)	(43.43)
ACCOUNTS RECEIVABLEt-1	0.0073***	0.1885***	-0.0070***	0.0206***	0.0225***	0.2152***	-0.0275***	0.0125***
	(3.09)	(83.58)	(-5.74)	(9.13)	(9.32)	(100.91)	(-22.15)	(6.94)
TURNOVERt-1	0.0014***	0.0270***	0.0001	-0.0109***	-0.0044***	0.0359***	0.0002	-0.0078***
	(3.06)	(61.02)	(0.50)	(-24.76)	(-9.45)	(86.92)	(0.73)	(-22.44)
SD CASHFLOWt-1	0.0628***	0.0815***	0.1459***	0.1122***	0.0462***	0.0623***	0.1543***	0.1065***
	(17.91)	(24.26)	(80.56)	(33.41)	(11.95)	(18.27)	(77.58)	(36.93)
Economic Group	yes	yes	yes	yes	yes	yes	yes	yes
Business sector	yes	yes	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	179,350				179,008			
R^2	0.107	0.211	0.223	0.220	0.138	0.227	0.264	0.163

(Table 2.9 Continued)

Panel B - Medium and large firms

	Medium				Large			
	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra group	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra group
PROFITABILITYt-1	-0.2474***	-0.2598***	-0.1184***	-0.1352***	-0.4349***	-0.2408***	-0.0612***	-0.0787***
	(-25.12)	(-32.27)	(-26.64)	(-22.11)	(-18.17)	(-12.39)	(-6.77)	(-4.17)
SALES GROWTHt-1	0.0040	0.0092***	0.0028*	0.0016	0.0221**	-0.0096	0.0055*	0.0066
	(1.14)	(3.22)	(1.74)	(0.75)	(2.52)	(-1.35)	(1.67)	(0.95)
SIZEt-1	0.0118***	0.0165***	-0.0279***	0.0028***	-0.0072***	0.0131***	-0.0147***	0.0047***
	(11.25)	(19.35)	(-59.19)	(4.29)	(-3.33)	(7.46)	(-17.94)	(2.73)
TANGIBILITYt-1	0.2035***	-0.0250***	-0.0339***	0.0209***	0.1640***	-0.0000	-0.0136***	0.0455***
	(34.28)	(-5.16)	(-12.64)	(5.66)	(12.59)	(-0.00)	(-2.77)	(4.43)
AGE	-0.0199***	-0.0159***	-0.0054***	-0.0092***	0.0196***	-0.0228***	-0.0014	-0.0117***
	(-11.91)	(-11.64)	(-7.22)	(-8.89)	(5.51)	(-7.87)	(-1.04)	(-4.17)
INVENTORIESt-1	0.2318***	0.1167***	-0.0668***	0.0043	0.1758***	0.1381***	-0.0420***	-0.0301*
	(28.12)	(17.32)	(-17.95)	(0.85)	(7.65)	(7.40)	(-4.83)	(-1.66)
ACCOUNTS RECEIVABLEt-1	0.0544***	0.1584***	-0.0163***	-0.0078*	0.0398***	0.0753***	-0.0029	-0.0092
	(8.44)	(30.03)	(-5.59)	(-1.94)	(2.74)	(6.37)	(-0.52)	(-0.81)
TURNOVERt-1	-0.0222***	0.0443***	0.0008	-0.0002	-0.0297***	0.0541***	0.0088***	-0.0027
	(-17.74)	(43.27)	(1.34)	(-0.30)	(-10.10)	(22.67)	(7.91)	(-1.15)
SD CASHFLOWt-1	-0.0472***	0.0528***	0.1543***	0.1050***	-0.0686*	0.0972***	0.1068***	0.0673**
	(-4.14)	(5.67)	(30.01)	(14.83)	(-1.78)	(3.11)	(7.35)	(2.22)
Economic Group	yes	yes	yes	yes	yes	yes	yes	yes
Business sector	yes	yes	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	27,924				4,907			
R^2	0.158	0.263	0.31	0.176	0.203	0.344	0.481	0.229

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The results were obtained running a SUR, with robust standard errors and clustering at firm level. Firm's characteristics were included as regressors with a lag, with exception of the variable Age. All specifications included a constant term.

2.7 Robustness tests

We ran some additional specifications in order to test the sensitivity of the results obtained to some of the hypotheses adopted. The results of the robustness tests are presented in the Appendices Section of this Chapter.

First, due to the changes recorded in 2010 (IES's templates and accounting rules), which required some hypotheses and some adjustments in the data, in this section we split the sample period into two sub-periods: 2006-2009 and 2010-2012. We re-estimate the specifications for the two sub-periods. Tables II.3 and II.4 in the Appendices Section present some descriptive statistics for firm characteristics for each sub-period. The econometric results are presented in Tables II.5 and II.6.

The main conclusions obtained for the full sample period do not change when we analyze the results for the each of the two sub-periods. Even though the magnitudes of the coefficients estimated are different, as expected, the relationships observed between firm's characteristics and funding sources persist. Nevertheless, there are some changes that are worth mentioning. Looking at the results in Table II.6, the coefficient of SALES GROWTH does not preserve the positive coefficient after 2009 for some funding sources. Additionally, ACCOUNTS RECEIVABLE has a varying impact over the sample period, namely for bank credit (it is not statistically significant in the period before 2009, and it is positive thereafter) as does for loans from shareholder or intra-group operations (with opposite coefficients in the two sub-periods, positive and negative, respectively).

Another robustness exercise was the restriction of the data set to observations with positive figures for the four funding sources under analysis. Under this framework, the data set was limited to around 91,000 observations. The results are presented in Tables II.7 and II.8.

Generally, the results are in line with those obtained previously. Nevertheless, there are some differences. Focusing on the results with the larger set of explanatory variables, Table II.8, one of the main differences is in ACCOUNTS RECEIVABLE. In this setup, the coefficient is positive only for trade credit. For the remaining funding sources the relationship is negative. SALES GROWTH is now statistically significant for tax liabilities, with a negative coefficient, but the magnitude of the coefficients remain small. In turn, AGE presents negative and statistically significant coefficients in all funding sources. TURNOVER presents positive coefficients, but in loans from shareholders or intra group operations.

Finally, in an additional robust test, we restrict the data set to a balanced panel data, which limited the number of observations in the dataset to around 284,000. In this framework the results (presented in Tables II.9 and II.10) remained broadly similar to those discussed in the previous sections. The main difference was related to AGE in loans from shareholder or intra-group operations, now showing a negative coefficient in all equations. This result may be an intrinsic consequence of the particular features of this data set (*i.e.* a balanced panel data), as all firms in the data set became older in the sample period.

2.8 Final Remarks

Funding is crucial for a firm's activity. The analysis of firm's capital decision (equity *versus* debt) is an important topic, but it is also valuable to explore the composition of corporate funding. Different types of debt have different characteristics and consequently different requirements for firms.

This study analyzes firm's funding components. In addition to bank credit and trade credit, two meaningful finance sources, we also include in the analysis tax lia-

bilities and loans granted by shareholders or intra-group operations. These funding sources are important in some corporate segments and raise several questions due to their specific characteristics. Tax liabilities may be related to a firm's liquidity management, exploiting the payment scheme, while loans from shareholder or intra-group operations suggest there are some differences on how owners finance their firms, *i.e.* through debt rather than equity. Therefore, this study sheds some light on these debt components, which are especially important for smaller and younger firms, segments that typically face more constraints in accessing to external finance.

In the first part of this study we explore the relevance of the main variables highlighted in the capital structure literature, such as variables related to bankruptcy costs, agency issues, and tax shields. However, given the specificities of some funding sources included in the analysis, we also explore indicators related to firm's activity and business risk as explanatory variables. Consistently across all specifications, profitability presents a negative relationship to the funding sources under analysis. Moreover, it is within the variables with sizable economic impact across the funding sources. The results also suggest that the variables related to firms' activity contain additional information for the analysis. In particular, activity indicators seem to be a relevant factor for different type of funding, even for bank credit and shareholder or intra-group loans. For riskier firms, tax liabilities, and, to a lesser extent, loans from shareholder or intra-group operations seem to play a role.

This study presents some important relationships between firm characteristics and the respective debt composition. The definition of a casual inference between the two dimensions is not easy. Nevertheless, this analysis contributes to increase the knowledge about the structure of corporate debt, and the main drivers of different funding sources (heterogeneous impacts). It also allows to see how these relationships may change across firms' size cohorts. Given the different characteristics of each debt component, the analysis also helps to identify potential vulnerabilities of

firms to economic and financial developments.

A better understanding of corporate funding may improve the analytical framework to define and assess policy measures. This may be especially important as firms in several countries, such as Portugal, present high indebtedness levels.

Appendices

Table II.1: Variables definition

Variables	**Definition**
Funding sources	
BANK CREDIT	Bank debt over total assets
TRADE CREDIT	Accounts payable over total assets
TAX LIABILITIES	Tax liabilities over total assets
SHAREHOLDER & INTRA-GROUP	Loans granted by shareholders and loans from firms in the same economic group over total assets
Firm's characteristics	
PROFITABILITY	Net earnings before provisions and depreciation over total assets
SALES GROWTH	Year-on-year change rate of sales
SIZE	Natural logarithm of real total assets
TANGIBILITY	Tangible assets over total assets
AGE	Natural logarithm of (1 + years)
INVENTORIES	Inventories over total assets
ACCOUNTS RECEIVABLE	Accounts receivable over total assets
TURNOVER	Sales over total assets
SD CASHFLOW	Standard deviation of cashflow over total assets
ECONOMIC GROUP	Dummy variable that takes the value 1 if the firm belongs to an economic group
BUSINESS SECTOR	Dummy variables of business sector (13 sectors)
Banking relationships	
BANKING RELATIONSHIP	Number of banking relationships defined at the banking group level, based on the weight of each group in firm's total bank debt
CREDIT LINE	Dummy variable that takes the value 1 if the firm has unused credit lines
LENGTH BANKINGREL	Natural logarithm of (1+ years of the longest banking relationship that a firm presents)

Table II.2: Correlation matrix

	BANK CREDIT	TRADE CREDIT	TAX LIAB.	SHAREH & IN. G.	PROFIT.	SALES GOWTH	SIZE	TANG.	INVENT.	ACC. REC.	TURNOV ER	AGE	SD CASHFOW	BANK REL.	CREDIT LINE	LENGTH BANKR.
BANK CREDIT	1															
TRADE CREDIT	-0.0706*	1														
TAX LIABILITIES	-0.1160*	-0.0089*	1													
SHAREH & INTRA-GROUP	-0.1247*	-0.0800*	0.0060*	1												
PROFITABILITY	-0.1391*	-0.1993*	-0.1945*	-0.2028*	1											
SALES GOWTH	-0.0318*	0.0208*	-0.0168*	-0.0083*	0.2113*	1										
SIZE	0.1799*	0.0513*	-0.3553*	-0.1345*	0.1391*	0.0291*	1									
TANGIBILITY	0.1846*	-0.2103*	-0.1089*	0.0676*	0.0385*	0.0253*	-0.0026*	1								
INVENTORIES	0.0535*	0.1484*	-0.1320*	0.1195*	-0.1424*	-0.0339*	0.0653*	-0.2986*	1							
ACC. RECEIVABLE	-0.0909*	0.2425*	0.0409*	-0.1170*	0.0617*	0.0252*	0.1003*	-0.3809*	-0.2530*	1						
TURNOVER	-0.1367*	0.1457*	0.2476*	-0.0025*	-0.0029*	0.1274*	-0.4016*	-0.0851*	-0.1125*	-0.0011	1					
AGE	0.0276*	-0.0999*	-0.1539*	-0.0436*	0.0007	-0.1975*	0.3120*	-0.0423*	0.0858*	-0.0068*	-0.1406*	1				
SD CASHFLOW	-0.0335*	0.0471*	0.3401*	0.1487*	-0.3536*	-0.0173*	-0.3853*	-0.0182*	-0.0774*	-0.0818*	0.3188*	-0.1620*	1			
BANK RELATIONSHIP	0.0648*	0.0033*	-0.0366*	0.0154*	0.0241*	0.0178*	0.0125*	0.0836*	0.0027*	-0.0268*	-0.0434*	-0.0382*	-0.0343*	1		
CREDIT LINE	0.2729*	0.0535*	-0.1905*	-0.1259*	0.0405*	-0.0063*	0.3781*	0.0166*	0.0284*	0.1043*	-0.1096*	0.1651*	-0.1683*	0.1627*	1	
LENGTH BANKREL.	0.3225*	0.0293*	-0.1924*	-0.1339*	0.0408*	-0.1065*	0.4397*	0.0433*	0.0570*	0.1097*	-0.2065*	0.4530*	-0.2285*	0.3747*	0.5549*	1

Notes : * means that the correlation is significant at the 5 per cent level. BANK CREDIT - Bank debt over total assets; TRADE CREDIT - Accounts payable over total assets; TAX LIABILITIES - Tax liabilities over total assets; SHAREH & ITRA-GROUP - Loans granted by shareholders and loans from firms in the same economic group over total assets; PROFITABILITY - Net earning before provisions and deprsciation over total assets; SALES GOWTH - Year-on-year change rate of sales; SIZE - Natural logarithm of real total assets; TANGIBILITY - Tangible assets over total assets; INVENTORIES - Inventories over total assets; ACC. RECEIVABLE - Accounts receivable over total assets; TURNOVER - Sales over total assets; AGE - Natural logarithm of (1+ age in years); SD CASHFLOW - Standard deviation of cashflow over total assets; BANKING RELATIONSHIP - Number of banking relationships defined at the banking group level, based on the relevance of each group in firm's total banking debt; CREDIT LINE - Dummy variable that takes the value 1 if the firm has unused credit lines; LENGTH BANKREL - Natural logarithm of (1+ years of the longest banking relationship that a firm presents).

Table II.3: Summary statistics - Firm characteristics - 2006-09

	Nr.	**mean**	**sd**	**p10**	**p25**	**p50**	**p75**	**p90**
PROFITABILITY	398,136	0.05	0.17	-0.09	0.01	0.06	0.12	0.21
SALES GROWTH	334,054	-0.01	0.32	-0.35	-0.14	-0.01	0.12	0.33
TANGIBILITY	398,136	0.27	0.24	0.02	0.07	0.20	0.41	0.64
SIZE	398,136	13.05	1.57	11.20	12.00	12.93	13.95	15.05
AGE	398,136	2.41	0.89	1.10	1.95	2.48	3.04	3.47
ASSET TURNOVER	398,136	1.50	1.19	0.40	0.72	1.19	1.89	2.96
INVENTORIES	398,136	0.19	0.23	0.00	0.00	0.09	0.30	0.56
ACCOUNTS RECEIVABLE	398,136	0.24	0.23	0.00	0.01	0.20	0.41	0.59
CASHFLOW VOLATILITY	387,523	0.11	0.15	0.02	0.03	0.06	0.13	0.26
BANKING RELATIONSHIP	398,136	0.61	0.36	0.00	0.36	0.63	1.00	1.00
LENGH BANKREL.	398,136	1.52	0.92	0.00	0.69	1.95	2.30	2.48
CREDIT LINE	398,136	0.56	0.50	0.00	0.00	1.00	1.00	1.00

Note: sd stands for standard deviation. p10, p25, p50, p75, and p90 stand for, respectively, the percentiles 10, 25, 50, 75, and 90 of the distribution of each variable.

Table II.4: Summary statistics - Firm characteristics - 2010-12

	Nr.	**mean**	**sd**	**p10**	**p25**	**p50**	**p75**	**p90**
PROFITABILITY	257,051	0.02	0.17	-0.15	0.00	0.04	0.10	0.17
SALES GROWTH	234,396	-0.06	0.31	-0.41	-0.18	-0.04	0.09	0.27
TANGIBILITY	257,051	0.26	0.24	0.01	0.06	0.19	0.41	0.65
SIZE	257,013	13.11	1.57	11.27	12.07	12.99	14.01	15.12
AGE	257,051	2.63	0.74	1.61	2.20	2.64	3.18	3.53
ASSET TURNOVER	257,051	1.45	1.20	0.36	0.67	1.12	1.81	2.89
INVENTORIES	257,051	0.17	0.22	0.00	0.00	0.07	0.26	0.51
ACCOUNTS RECEIVABLE	257,051	0.26	0.24	0.00	0.02	0.21	0.42	0.61
CASHFLOW VOLATILITY	251,406	0.11	0.14	0.02	0.03	0.06	0.12	0.23
BANKING RELATIONSHIP	257,051	0.57	0.35	0.00	0.31	0.55	0.99	1.00
LENGH BANKREL.	257,051	1.75	0.97	0.00	1.10	2.08	2.56	2.71
CREDIT LINE	257,051	0.65	0.48	0.00	0.00	1.00	1.00	1.00

Note: sd stands for standard deviation. p10, p25, p50, p75, and p90 stand for, respectively, the percentiles 10, 25, 50, 75, and 90 of the distribution of each variable.

Table II.5: Capital structure standard regressors - Sub-periods

	2006-2009				2010-2012			
	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group
PROFITABILITYt-1	-0.2254***	-0.2415***	-0.1236***	-0.3235***	-0.1625***	-0.2584***	-0.1374***	-0.1458***
	(-81.03)	(-88.49)	(-78.73)	(-115.22)	(-46.40)	(-79.41)	(-75.06)	(-59.37)
SALES GROWTHt-1	0.0031***	0.0207***	0.0031***	0.0050***	-0.0041**	0.0222***	0.0062***	0.0064***
	(2.83)	(18.96)	(4.91)	(4.44)	(-2.56)	(14.85)	(7.38)	(5.65)
SIZEt-1	0.0298***	0.0093***	-0.0195***	-0.0247***	0.0259***	0.0055***	-0.0207***	-0.0037***
	(107.44)	(34.01)	(-124.41)	(-88.20)	(73.35)	(16.93)	(-112.04)	(-15.14)
TANGIBILITYt-1	0.0852***	-0.1245***	-0.0454***	0.0534***	0.2492***	-0.1054***	-0.0447***	0.0094***
	(49.06)	(-73.06)	(-46.34)	(30.50)	(110.12)	(-50.11)	(-37.75)	(5.92)
AGE	-0.0125***	-0.0366***	-0.0108***	0.0012**	-0.0265***	-0.0409***	-0.0129***	0.0002
	(-21.24)	(-63.32)	(-32.35)	(1.99)	(-33.43)	(-55.54)	(-31.16)	(0.29)
2008	0.0068***	-0.0062***	-0.0047***	-0.0009				
	(7.51)	(-6.95)	(-9.27)	(-0.93)				
2009	0.0159***	-0.0148***	-0.0082***	-0.0061***				
	(17.48)	(-16.53)	(-15.95)	(-6.63)				
2012					-0.0120***	-0.0005	0.0019***	-0.0002
					(-12.03)	(-0.50)	(3.66)	(-0.24)
Economic Group	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes
Business sector	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	220,639				139,163			
R^2	0.092	0.162	0.156	0.114	0.131	0.144	0.194	0.310

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The results were obtained running a SUR, with robust standard errors and clustering at firm level. Firm's characteristics were included as regressors with a lag, with exception of the variable Age. All specifications included a constant term.

Table II.6: Additional regressors: Activity indicators - Sub-periods

	2006-2009				2010-2012			
	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group
PROFITABILITYt-1	-0.1844***	-0.2383***	-0.0980***	-0.2292***	-0.1248***	-0.2160***	-0.1047***	-0.1110***
	(-62.27)	(-84.40)	(-60.47)	(-77.86)	(-33.36)	(-64.65)	(-55.17)	(-42.42)
SALES GROWTHt-1	0.0047***	0.0075***	-0.0021***	0.0086***	-0.0010	0.0029**	0.0001	0.0068***
	(4.23)	(7.07)	(-3.45)	(7.81)	(-0.60)	(1.97)	(0.14)	(5.98)
SIZEt-1	0.0293***	0.0153***	-0.0126***	-0.0261***	0.0254***	0.0166***	-0.0141***	-0.0023***
	(95.58)	(52.35)	(-75.36)	(-85.80)	(65.36)	(47.73)	(-71.74)	(-8.28)
TANGIBILITYt-1	0.1087***	-0.0187***	-0.0617***	0.0974***	0.2701***	-0.0003	-0.0491***	0.0181***
	(53.86)	(-9.74)	(-55.87)	(48.55)	(104.79)	(-0.11)	(-37.57)	(10.02)
AGE	-0.0132***	-0.0347***	-0.0078***	0.0013**	-0.0267***	-0.0374***	-0.0101***	-0.0001
	(-22.45)	(-61.95)	(-24.27)	(2.20)	(-33.71)	(-52.86)	(-25.04)	(-0.20)
INVENTORIESt-1	0.0962***	0.1147***	-0.0619***	0.1565***	0.0584***	0.1281***	-0.0522***	0.0515***
	(45.47)	(56.86)	(-53.51)	(74.42)	(20.26)	(49.70)	(-35.66)	(25.52)
ACCOUNTS RECEIVABLEt-1	0.0018	0.2053***	-0.0162***	0.0309***	0.0374***	0.1939***	-0.0117***	-0.0081***
	(0.88)	(102.96)	(-14.17)	(14.87)	(13.74)	(79.64)	(-8.43)	(-4.24)
TURNOVERt-1	-0.0033***	0.0258***	0.0030***	-0.0145***	-0.0087***	0.0300***	0.0083***	-0.0023***
	(-8.88)	(72.00)	(14.47)	(-38.73)	(-17.26)	(66.31)	(32.24)	(-6.57)
SD CASHFLOWt-1	0.0563***	0.0628***	0.2296***	0.2048***	0.0990***	0.1244***	0.1645***	0.0881***
	(13.91)	(16.27)	(103.75)	(50.92)	(21.97)	(30.90)	(71.97)	(27.93)
Economic Group	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes
Business sector	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	220,639				139,163			
R^2	0.104	0.219	0.217	0.152	0.138	0.215	0.248	0.318

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The results were obtained running a SUR, with robust standard errors and clustering at firm level. Firm's characteristics were included as regressors with a lag, with exception of the variable Age. All specifications included a constant term.

Table II.7: Capital structure standard regressors - All funding positive

	Model 1				Model 2				Model 3			
	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group
PROFITABILITYt-1	-0.3015***	-0.2238***	-0.1460***	-0.4425***	-0.3029***	-0.2261***	-0.1464***	-0.4409***	-0.2946***	-0.2247***	-0.1504***	-0.4319***
	(-60.26)	(-49.21)	(-63.83)	(-88.84)	(-60.64)	(-49.70)	(-64.00)	(-88.50)	(-58.89)	(-50.62)	(-66.38)	(-86.73)
SALES GROWTHt-1	0.0086***	0.0089***	0.0009	0.0065***	0.0108***	0.0086***	0.0008	0.0051***	0.0080***	0.0158***	0.0005	0.0021
	(5.04)	(5.74)	(1.21)	(3.81)	(6.29)	(5.52)	(1.04)	(2.97)	(4.67)	(10.44)	(0.69)	(1.22)
SIZEt-1	0.0166***	-0.0059***	-0.0154***	-0.0317***	0.0166***	-0.0061***	-0.0154***	-0.0316***	0.0174***	-0.0070***	-0.0148***	-0.0307***
	(38.28)	(-14.89)	(-77.51)	(-73.24)	(38.18)	(-15.34)	(-77.62)	(-72.95)	(39.40)	(-17.89)	(-74.02)	(-69.91)
TANGIBILITYt-1	0.1084***	-0.1656***	-0.0119***	0.0450***	0.1081***	-0.1650***	-0.0117***	0.0450***	0.1021***	-0.1386***	-0.0267***	0.0068**
	(45.03)	(-75.69)	(-10.84)	(18.77)	(45.02)	(-75.47)	(-10.67)	(18.80)	(37.74)	(-57.76)	(-21.82)	(2.54)
AGE	-0.0153***	-0.0245***	-0.0035***	-0.0031***	-0.0150***	-0.0246***	-0.0035***	-0.0033***	-0.0120***	-0.0308***	-0.0042***	-0.0026***
	(-16.15)	(-28.45)	(-8.00)	(-3.26)	(-15.86)	(-28.54)	(-8.20)	(-3.45)	(-12.57)	(-36.27)	(-9.68)	(-2.71)
Economic Group	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Business sector	no	no	no	no	no	no	no	no	yes	yes	yes	yes
Nr.	91,365				91,365				91,365			
R^2	0.0662	0.1005	0.1216	0.1511	0.0715	0.1023	0.1226	0.1226	0.0830	0.1591	0.1533	0.1668

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The results were obtained running a SUR, with robust standard errors and clustering at firm level. Firm's characteristics were included as regressors with a lag, with exception of the variable Age. All specifications included a constant term.

Table II.8: Additional regressors: Activity indicators - All funding positive

	Model 1			
	Bank Credit	Trade Credit	Tax Credit	Shareholder & Intra group
PROFITABILITYt-1	-0.2407***	-0.2343***	-0.1253***	-0.3325***
	(-45.61)	(-52.09)	(-53.75)	(-64.12)
SALES GROWTHt-1	0.0071***	0.0025*	-0.0030***	0.0052***
	(4.18)	(1.69)	(-4.02)	(3.07)
SIZEt-1	0.0194***	0.0047***	-0.0109***	-0.0296***
	(41.25)	(11.66)	(-52.37)	(-64.14)
TANGIBILITYt-1	0.1134***	-0.0424***	-0.0410***	0.0169***
	(32.56)	(-14.28)	(-26.67)	(4.95)
AGE	-0.0119***	-0.0280***	-0.0019***	-0.0025***
	(-12.50)	(-34.56)	(-4.40)	(-2.65)
INVENTORIESt-1	0.0615***	0.0570***	-0.0460***	0.0807***
	(17.30)	(18.80)	(-29.29)	(23.08)
ACCOUNTS RECEIVABLSt-1	-0.0419***	0.1877***	-0.0131***	-0.0568***
	(-11.21)	(58.93)	(-7.96)	(-15.48)
TURNOVERt-1	0.0019***	0.0345***	0.0066***	-0.0116***
	(2.70)	(56.94)	(21.11)	(-16.68)
SD CASHFLOWt-1	0.1113***	0.1278***	0.1405***	0.2189***
	(20.07)	(27.03)	(57.34)	(40.16)
Economic Group	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes
Business sector	yes	yes	yes	yes
Nr.	91,365			
R^2	0.0970	0.2353	0.2066	0.2000

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The results were obtained running a SUR, with robust standard errors and clustering at firm level. Firm's characteristics were included as regressors with a lag, with exception of the variable Age. All specifications included a constant term.

Table II.9: Capital structure standard regressors - Balanced panel data

	Model 1				Model 2				Model 3			
	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group	Bank Credit	Trade Credit	Tax Lliabilities	Shareholder & Intra Group	Bank Credit	Trade Credit	Tax Liabilities	Shareholder & Intra Group
PROFITABILITYt-1	-0.2268***	-0.2467***	-0.0780***	-0.1876***	-0.2139***	-0.2515***	-0.0753***	-0.2049***	-0.2122***	-0.2299***	-0.0837***	-0.1996***
	(-83.50)	(-96.97)	(-63.81)	(-83.45)	(-78.98)	(-98.23)	(-61.15)	(-92.02)	(-77.76)	(-92.07)	(-68.75)	(-89.12)
SALES GROWTHt-1	-0.0064***	0.0271***	0.0041***	0.0200***	0.0059***	0.0257***	0.0053***	0.0070***	0.0054***	0.0307***	0.0052***	0.0057***
	(-5.39)	(24.44)	(7.67)	(20.45)	(4.92)	(22.80)	(9.87)	(7.16)	(4.54)	(28.13)	(9.78)	(5.81)
SIZEt-1	0.0237***	0.0118***	-0.0184***	-0.0141***	0.0242***	0.0117***	-0.0183***	-0.0147***	0.0250***	0.0064***	-0.0170***	-0.0137***
	(105.44)	(56.05)	(-181.37)	(-75.97)	(108.46)	(55.45)	(-180.68)	(-80.30)	(106.83)	(30.00)	(-162.78)	(-71.54)
TANGIBILITYt-1	0.1711***	-0.1551***	-0.0244***	0.0453***	0.1736***	-0.1556***	-0.0241***	0.0423***	0.1803***	-0.1155***	-0.0368***	0.0321***
	(121.37)	(-117.51)	(-38.44)	(38.88)	(124.35)	(-117.96)	(-37.95)	(36.90)	(119.06)	(-83.32)	(-54.47)	(25.83)
AGE	-0.0195***	-0.0364***	-0.0036***	-0.0042***	-0.0228***	-0.0356***	-0.0042***	-0.0000	-0.0216***	-0.0358***	-0.0056***	-0.0010**
	(-34.95)	(-69.52)	(-14.50)	(-9.13)	(-41.05)	(-67.69)	(-16.57)	(-0.00)	(-38.08)	(-69.01)	(-22.23)	(-2.10)
2008					0.0052***	-0.0085***	-0.0020***	0.0001	0.0053***	-0.0080***	-0.0021***	-0.0001
					(4.46)	(-7.72)	(-3.89)	(0.06)	(4.57)	(-7.51)	(-4.03)	(-0.08)
2009					0.0185***	-0.0183***	-0.0022***	-0.0032***	0.0185***	-0.0168***	-0.0023***	-0.0034***
					(15.95)	(-16.73)	(-4.24)	(-3.39)	(15.97)	(-15.90)	(-4.55)	(-3.57)
2010					0.0668***	-0.0121***	0.0005	-0.0579***	0.0667***	-0.0099***	0.0004	-0.0582***
					(57.41)	(-10.98)	(0.97)	(-60.55)	(57.39)	(-9.30)	(0.74)	(-60.96)
2011					0.0551***	-0.0187***	0.0016***	-0.0536***	0.0550***	-0.0163***	0.0014***	-0.0537***
					(47.27)	(-17.01)	(3.06)	(-55.92)	(47.25)	(-15.32)	(2.67)	(-56.15)
2012					0.0475***	-0.0194***	0.0071***	-0.0540***	0.0473***	-0.0160***	0.0067***	-0.0540***
					(40.26)	(-17.41)	(13.22)	(-55.76)	(40.20)	(-14.81)	(12.71)	(-55.89)
Economic Group	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Business sector	no	no	no	no	no	no	no	no	yes	yes	yes	yes
Nr.	284,591				284,591				284,591			
R^2	0.0983	0.0955	0.1328	0.1238	0.1164	0.0970	0.1341	0.1530	0.1191	0.1559	0.1679	0.1581

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The results were obtained running a SUR, with robust standard errors and clustering at firm level. Firm's characteristics were included as regressors with a lag, with exception of the variable Age. All specifications included a constant term.

Table II.10: Additional regressors: Activity indicators - Balanced panel data

	Model 1			
	Bank Credit	Trade Credit	Tax Credit	Shareholder & Intra group
PROFITABILITYt-1	-0.1820***	-0.2283***	-0.0736***	-0.1434***
	(-63.45)	(-90.60)	(-59.32)	(-61.43)
SALES GROWTHt-1	0.0066***	0.0138***	0.0003	0.0083***
	(-5.55)	(-13.14)	(-0.6)	(-8.57)
SIZEt-1	0.0240***	0.0141***	-0.0114***	-0.0138***
	(-93.41)	(-62.71)	(-103.00)	(-66.24)
TANGIBILITYt-1	0.2068***	-0.0075***	-0.0381***	0.0534***
	(-117.81)	(-4.83)	(-50.21)	(-37.36)
AGE	-0.0220***	-0.0340***	-0.0042***	-0.0014***
	(-38.86)	(-68.37)	(-17.02)	(-3.05)
INVENTORIESt-1	0.0824***	0.1196***	-0.0395***	0.0998***
	(-42.18)	(-69.65)	(-46.73)	(-62.72)
ACCOUNTS RECEIVABLEt-1	0.0362***	0.1992***	-0.0079***	0.0090***
	(-19.5)	(-122.1)	(-9.83)	(-5.97)
TURNOVERt-1	-0.0050***	0.0318***	0.0080***	-0.0095***
	(-14.68)	-106.17	-54.58	(-34.21)
SD CASHFLOWt-1	0.0273***	0.0375***	0.1465***	0.1095***
	(-7.99)	(-12.47)	(-98.97)	(-39.31)
Economic Group	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes
Business sector	yes	yes	yes	yes
Nr.	284,591			
R^2	0.1258	0.2282	0.1785	0.2244

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The results were obtained running a SUR, with robust standard errors and clustering at firm level. Firm's characteristics were included as regressors with a lag, with exception of the variable Age. All specifications included a constant term.

Chapter 3

Lending relationships and the real economy: evidence in the context of the euro area sovereign debt crisis

Abstract: The recent euro area sovereign debt crisis put the financial sector under pressure and imposed several challenges, mainly in the countries most affected by the crisis. The sovereign-bank linkage can negatively affect the economic activity, especially by bank-dependent firms. This study explores the heterogeneity across banks in their funding structure, sovereign exposures, solvency, and availability of collateral, with the aim of investigating the effect of the crisis on firms' investment and employment decisions. Exploring a detailed database that covers virtually all bank loans granted to Portuguese firms, for the period 2007-2012, the results suggest an impact on investment and employment paths for firms whose lenders depend more heavily on interbank and market funding. Moreover, the results also stress the importance of assets eligible as collateral in monetary operations conducted by Central Bank. The findings suggest how a deterioration in

sovereign creditworthiness can affect the real economy via the banking sector.

JEL Classification: G21, G31, E22, E24, E44, E51

Keywords: Sovereign debt crisis, heterogeneity firm's lenders, firm's investment and employment

3.1 Introduction

Financial intermediation ensures the flow of capital from savers to firms (or other agents), which is crucial for economic activity and growth. The recent financial and sovereign debt crises implied severe dysfunction in the international financial markets, with repercussions on financial institutions. These events raise the discussion of how the crisis affects financial intermediaries' ability to grant credit, and emphasize the importance of understanding how shocks to credit suppliers affect the real economy.

The financial crisis in 2008 imposed huge losses for financial institutions worldwide, and led to a dry-up in the interbank markets. Later, the Greek bailout in mid-2010 marked the onset of the sovereign debt crisis in the euro area. The unprecedented and unexpected nature of this event changed the assessment and perception of sovereign credit risk by market participants. The sovereign bond yields of other euro area countries increased considerably, especially for Ireland, Portugal, and to a lesser extent, Spain and Italy, while other financial markets were also affected (*e.g.* Benzoni et al. (2015)).

The sovereign debt crisis and the tensions in financial markets in general were transmitted to credit institutions through several channels. A direct link was the negative impact on the net worth of sovereign debt securities held by institutions. These losses weakened the balance sheets position, which made those institutions

appear to be riskier. Sovereign debt market developments also fueled the perception that Governments would have lower financial ability to support the national banking systems if needed. This too had severe implications for financial institutions. Indeed, the sovereign-bank linkage implied a marked increase in the funding cost for the institutions hosted or exposed to the stressed countries. Some institutions even lost access to the international financial markets in this period. This environment imposed several challenges to financial institutions and their activity.

This study investigates the effects of the sovereign debt crisis and financial market disruptions on corporate decisions in Portugal, namely firms' investment and employment, exploring the heterogeneity of firms' lenders. In particular, we compare investment and employment outcomes of firms that borrow from financial institutions with heterogeneous exposures to the sovereign and financial market developments.

Portugal figures as an interesting case study for several reasons. First, Portugal was at the core of the sovereign debt crisis in the euro area (Figure III.1, in the Appendices Section of this Chapter), which led to its rescue via International Financial Assistance in April 2011. Second, there were severe negative consequences on the Portuguese banking system, driven by the sovereign-bank linkage. Due to the increasing tensions and risk aversion in financial markets, Portuguese banks have faced daunting liquidity challenges since 2010 (Figure III.2, in the Appendices Section). This fact is especially relevant as the banking system plays a critical role as a funding source to the Portuguese economy, notably to the corporate sector.[1] Portuguese firms, comprising mainly small and medium sized-firms (SMEs), present high leverage ratios, making them more vulnerable to changes in credit institutions' financial positions. Moreover, SMEs have less access to alternative financial instru-

[1]In Portugal, and broadly in Europe, banks play an important role in financial intermediation, in contrast with other economies, such as that of the USA, where wholesale markets are also important, as discussed in Langfield & Pagano (2015).

ments. Finally, it is worth mentioning that the initial shock was exogenous to the Portuguese banking system, and not driven by developments in the corporate sector.[2] Indeed, the increases in the Portuguese sovereign bond yields, in opposition to other countries, such as Ireland and Spain, were not driven by the Government support to the banking system or a price bubble in the real estate market. In fact, it was related essentially to the higher concerns, following the Greek bailout, related to the Portuguese macroeconomic imbalances, namely the weakness of Portuguese public finance (excessive debt levels and high deficits). These factors are important in the analysis, as banks did not anticipate the developments recorded from mid-2010 on, and the resulting loss of access to the international wholesale debt markets.

This study contributes to the literature that analyzes the impact of bank-sovereign linkage on a firm's decisions. To perform the analysis, we use detailed micro databases for Portuguese firms and financial institutions, which allows us to match firm-bank, to explore the intensity of these relationships, and to cover different segments of the corporate sector. We investigate if there are differences in firms' investment and employment decisions based on firm-lenders relationships and the characteristics of respective lenders. Namely, we characterize firms' lenders, based on several key indicators, and identify those relationships that could be more vulnerable to the negative shock recorded in international financial markets in 2010. To the best of our knowledge, the paper most similar to ours is the recent work of Bottero et al. (2015). However, in this study we explore alternative channels of transmission from banks to firms that may be helpful in identifying banks more vulnerable to adverse financial developments.

According to the results obtained, the key lenders' characteristics that affect firms' decisions are related to banks' market funding positions, with a negative

[2] As mentioned in Banco de Portugal (2011*b*), "*Portuguese banks' liquidity difficulties resulted, to a large extent, from a contagion effect deriving from disturbances in sovereign debt markets and not directly from intrinsic problems of solvency or profitability*".

effect on both investment and employment. As the dependence of banks on these funding sources increases, their borrowers tend to present lower investment and employment paths. In turn, assets eligible as collateral in monetary operations seem to have a favorable impact on both firms' decisions. Looking at banks' sovereign debt exposures and regulatory capital ratios, the results are mixed.

This Chapter is structured as follows: Section 3.2 presents a brief review of related literature. Section 3.3 presents the main facts regarding the Portuguese banking system under the International Financial Assistance Programme to Portugal. Section 3.4 describes the data sources, and the data set used in the analysis. Section 3.5 shows the empirical strategy adopted and presents some summary statistics for the variables under analysis. Section 3.6 presents the empirical specification and the econometric results. Section 3.7 explores an alternative empirical approach. Section 3.8 shows some robustness tests. Finally, Section 3.9 presents the main conclusions.

3.2 Related literature

The value of the banking system and its impact on the real economy is not a new topic in economic and financial literature. For instance, Bernanke (1983) discussed the relevance of banks' balance sheet channel. He showed that shocks to banks' financial positions affect lending and consequently borrowers' decisions and real activity. Holmstrom & Tirole (1997) presented a model of financial intermediation in which firms and intermediaries could be capital constrained. They emphasized the role of the financial intermediaries, in addition to the wholesale market, showing that some firms have access only to external funds through those institutions or given their monitoring function. Moreover, the authors show how changes in banks' capital positions affect their credit supply, which is particularly important to less

capitalized firms.

The link between the real economy and the financial sector was also emphasized in papers related to the so-called "*financial accelerator*". This literature argues that due to the existence of imperfections in the credit markets the general financial conditions account for the intensity and persistence of the economic business cycles (*e.g.* Bernanke & Gertler (1989) and Bernanke et al. (1999)). The asymmetric information on credit markets is especially important to smaller, younger, or less transparent borrowers, contributing to a greater sensitivity of this segment of firms to changes in the credit supply (*e.g.* Mark Gertler (1994)). King & Levine (1993), for instance, found evidence that the financial system can promote economic growth. Namely, financial developments are related to GDP growth, physical capital accumulation, and efficiency, as well as to the future evolution of these variables. The credit market imperfections and the impact of financial frictions/conditions on firms' decisions have also been a central topic in corporate finance research, both in theoretical and empirical perspectives (*e.g.* the seminal paper Fazzari et al. (1987), or Love (2003)).

Given its place in the financial system, bank credit has attracted intense interest in the financial literature, notably the firm-bank relationships. According to this literature, in the borrowers' perspective, there is evidence that the number of lending relationships and the length of these relationships may affect the availability of credit and contracts conditions, *e.g.* Petersen & Rajan (1994), Ongena & Smith (1998), Boot (2000), and Berger & Udell (2006). An important point in this literature is the acquisition of soft information through repeated interactions between borrowers and lenders (*e.g.* Diamond (1984)), which helps to minimize asymmetric information issues. Nevertheless, this information acquisition, and the reliance on only a few lenders, may also contribute to hold-up problems for firms (for instance, information rents, as explored by Rajan (1992)), or switching costs (as discussed in Kim et al.

(2003), and recently in Chodorow-Reich (2014)). Under financial distress episodes, Hoshi et al. (1990) showed that Japanese firms with a main bank-lending relationship have been found to obtain lower costs of overcoming those events. Bae et al. (2002) explored adverse events that affected the Korean banking system during the Asian crisis in the late 1990s, and showed that adverse shocks to a firm's main lender have a negative knock-on effect not only on the value of the bank but also on the value of the firm itself.

More recently, the literature on financial-real economy linkage recorded a new wave, exploring the impact of the financial and the euro area sovereign debt crises on credit institutions and firms' decisions. While the financial crisis directly affected banks' financial health and the functioning of the interbank markets, the sovereign debt crisis may have affected financial markets and the financial institutions through several channels. Sovereign debt tensions had a direct negative impact on the market value of sovereign debt securities. Moreover, financial systems were also perceived as more vulnerable as the sovereign capacity to provide financial assistance decreased. In this context, banks' funding costs also increased. In a second round, the increases in sovereign yields may have induced changes in banks' decisions, contributing to portfolio adjustments, such as an increase in sovereign holdings for less risk averse institutions. These securities presented higher returns (which improve profitability), while they did not imply additional capital needs (zero risk weights in terms of capital requirements). This strategy may reinforce the bank-sovereign linkage. It may also imply a decrease in credit supply to other economic segments (*i.e.* a crowding out effect).

Some of the most recent research has assessed the impact of the crisis on banks' credit supply. Empirical evidence suggests a decrease in credit to firms, due to negative shocks in financial markets. Iyer et al. (2014) analyzed the impact of the financial crisis in 2008 on the credit supply in Portugal, exploring data from the

Central Credit Register. They found that banks more dependent on the interbank market restricted credit to firms to a greater extent than did banks less exposed to that market. Bofondi et al. (2013) investigated a similar research question for Italy during the sovereign debt crisis. Based on the distinction between foreign and domestic banks, as the latter were affected by Italian sovereign yield increases, they found that domestic banks decreased credit supply more than did the foreign ones. In turn, Popov & Horen (2015), and Adelino & Ferreira (2016) centered their analyses on the impact of the sovereign debt crisis on credit, evaluated through syndicated loans. Popov & Horen (2015) showed that banks with greater exposures to stressed countries recorded greater credit cuts. Exploring banks' rating downgrades as a consequence of respective sovereign ratings revisions, Adelino & Ferreira (2016) found that those banks revealed a greater impact on credit supply than did institutions that were not subject to this effect.

Another strand of the recent literature explores the potential impact of recent crises on firms' decisions, given the impact on the financial system and the relevance of bank credit as an external funding source to the corporate sector, in particular in Europe. The variables of interest are related to real decisions, such as employment and investment, as well as financial indicators, as leverage and sales growth. In general, the results suggest that there are differences in the path of firms' outcomes between firms less and more exposed to the financial and sovereign debt crises through their lenders. Based on syndicated loans, Chodorow-Reich (2014) first found that less healthy banks (exploring several metrics) reduced more credit than other banks during the financial crisis in the US.[3] He also found that firms that had pre-crisis relationships with weaker banks reduced more employment than did firms whose lenders were healthier. Similarly, Bentolila et al. (2015) found an impact on Spanish firms' employment policies. Firms that relied on weaker banks (in this

[3]Banks' position were assessed by alternative measures related to exposures to Lehman Brothers, exposures to toxic mortgage back securities, and some balance sheet indicators.

setup, bailout banks) showed greater employment drops than firms with relationships with healthier banks. Also in the context of the financial crisis, Cingano et al. (2013) found that Italian firms whose lenders were more dependent on interbank funding reduced their investment more than firms less dependent on such banks. In the context of the European sovereign debt crisis, Bottero et al. (2015), also based on Italian data, found that banks with higher exposures to Italian sovereign debt tightened more credit supply to firms. Moreover, they found that smaller and riskier firms were not able to overcome this fact, recording a reduction in investment and employment. De Marco (2016) and Acharya et al. (2016) analyzed the impact of sovereign debt crisis on firms' decisions, exploring syndicated loans data. On average, firms whose lenders were more exposed to sovereign debt of stressed countries (in De Marco (2016)) or firms whose lead lender was from those countries (in Acharya et al. (2016)) presented a more adverse path for some firms' outputs than firms with other lending relationships.

The impact of bank credit on firms' decisions may also depend on firms' ability to substitute bank relationships or/and bank credit with other funding sources. Adjustments in firms' debt components may minimize the effects of bank credit shocks. Some papers have explored this dynamic, but the empirical results are mixed. Becker & Ivashina (2014) and Adrian et al. (2012), exploring debt market as alternative funding sources, argued that there were no real effects that could be related to banks' lending paths. In turn, Carvalho et al. (2015) found that the access to public debt markets did not offset the impact of bank distress on firms' decisions. In turn, Almeida et al. (2016) explored the direct negative spillovers of sovereign rating downgrades on firms' ratings, which has a negative effect on firms' funding costs. Their results suggest that firms that recorded a rating downgrade due to the sovereign ceiling policy, *i.e.* firms should not present higher ratings than the respective sovereign (firms' downgrade were not directly related to firms' fundamentals),

showed greater impact on their decisions than did the other firms.[4] However, as mentioned, public debt markets are not available for all firms. Even firms that try to adjust funding within the banking system may face some important constraints. For instance, Ivashina & Scharfstein (2010) found evidence that borrowers of weaker banks could not switch to healthier banks during the financial crisis.

The present study contributes to the empirical literature that explores how the sovereign debt crisis affected financial intermediaries and corporate decisions. Looking at empirical literature, there are some papers with similarities to this analysis. Some of them analyze a similar time window, namely the euro area sovereign debt crisis, while others explore analogous databases, with special emphasis on the Central Credit Register. This database avoids the bias to larger firms that characterize some studies, such as those based on syndicated loans. Indeed, small and medium firms (SMEs) are a significant fraction of the corporate sector, and account for much of the economic activity and employment in several countries, such as Portugal. SMEs usually do not have access to the syndicated loan markets. They are typically more dependent on bank credit, and consequently more vulnerable to changes in bank credit supply. This study is also in line with papers that explore corporate decisions.

Combining all these features, to the best of our knowledge, the paper most similar to this one is the recent work of Bottero et al. (2015). The two papers investigate the impact of the sovereign debt crisis, exploring the Central Credit Register. This database allows a direct firm-lender match, and simultaneously an exploration of corporate heterogeneity. However, in this paper we directly explore several dimensions of a firm's lenders that may be relevant in the environment under analysis. Accordingly, in this study possible channels other than the direct exposure to sovereign debt securities are explored in more detail. For instance, we examine the structure

[4]In the Portuguese case there are few firms with rating notes and access to the wholesale funding. As a result, this direct impact is not sizeable.

of banks' liabilities, and especially the availability of collateral to gain access to the monetary operations conducted by the ECB, which has not deserved much attention in the literature in this context.

3.3 The Portuguese International Economic and Financial Assistance Programme: Main facts on the banking system

The international financial crisis following the US sub-prime mortgage crisis and the collapse of Lehman Brothers had little direct impact on the Portuguese banking system as a whole. In general, banks were not exposed to the sub-prime market and their exposures to *"toxic assets"* were contained. Moreover, unlike other economies, Portugal did not record a bubble in the real estate market. Nevertheless, Portuguese institutions were affected by changes in financial market conditions, in particular by the dry-up in the interbank market during this period. Those constraints were minimized by monetary operations conducted by Central Banks and by issuing bonds with government guarantees (Figure III.3, in the Appendices Section). As a result, lending to non-financial corporations continued to grow at high rates in Portugal during this period (Figure III.4, in the Appendices Section).

However, the sovereign debt crisis marked the onset of a new period that saw several deleterious effects on the Portuguese economy and the banking system. With the Greek bailout and the increasing tension in sovereign debt markets in the euro area, there was a reassessment of sovereign credit risk by market participants. The yields of Portuguese government bonds rose dramatically. The sovereign-banking system link and the risk aversion in financial markets posed several challenges to

Portuguese financial institutions. Given the increased weight of the international financial markets in the funding structure of Portuguese banks since the early 2000s (as a consequence of the financial integration in the context of the monetary union), and the exposure of Portuguese banks to sovereign debt securities, these developments required sizable adjustments in banks' funding and business strategies.

Due to the renewal of tensions in the European sovereign debt markets, which led to an escalation of the Portuguese bond yields, since end-2010, the Portuguese Government requested international assistance in April 2011. This led to the International Economic and Financial Assistance Programme (hereinafter Programme), defined for a horizon period of three years, and provided by the International Monetary Fund, the European Union, and the European Central Bank. The Programme focused on three main pillars: structural reforms and competitiveness of the Portuguese economy; fiscal consolidation; and deleverage of the financial and private sectors.

Looking at the banking system, the Programme sought to ensure an orderly and gradual deleveraging process and the reinforcement of regulatory capital positions. Simultaneously, a close assessment of the financial conditions in the economy was to be conducted, in order to ensure an equilibrium between the necessary deleveraging adjustment and the financial support to the economic activity. Three fundamental dimensions should be highlighted: *i)* the implementation of measures to ensure sufficient liquidity in the banking system; *ii)* the design of funding and capital plans for short and medium terms, to monitor the gradual deleveraging, the reduction of funding from the Eurosystem, and the path of capital needs; *iii)* the reinforcement of capital positions.

In order to achieve a stable funding structure, the Programme set specific targets for some key indicators. For instance, the Programme established a gradual conver-

gence to 120 per cent of the loan-to-deposit ratio.[5] As far as regulatory capital was concerned, the Programme imposed higher minimum levels to the Core Tier 1 ratio, namely 9 per cent by the end 2011 and 10 per cent by the end of 2012.

The Programme included a backstop facility of 12 billion euros to the financial system (out of the 78 billion euros included in the Programme), in order to face potential capital needs, due to the new capital requirements and the adverse economic and financial environment that was foreseen during the horizon period of the Programme. Note that low capital ratios, *i.e.* close to the minimum regulatory threshold, may have a direct impact on a bank's activity.

In parallel, due to the general tensions in the sovereign debt markets in the euro area and the exposure of the European banks to sovereign assets, in 2011 the European Banking Authority (EBA) imposed the so-called "*sovereign capital buffer*" on the major banks in the European Union.[6] The "*sovereign capital buffer*" was computed taking into account banks' sovereign debt portfolios and the respective market value assessed in September 2011. This buffer was to be in place by the end of June 2012. These new rules imposed additional capital needs on some Portuguese banks.[7]

Therefore, banks had to manage their capital positions in order to meet all the new capital requirements. Against this background some banks realized significant capital increases over these years. Some of them applied to the financial system facility included in the Programme, namely BCP, Banco BPI (mostly due to the "*sovereign capital buffer*"), and Banif. CGD also increased its capital significantly, but in a different set up, given that CGD is a state-owned bank. Additionally, in

[5]However, these targets were revised during the Programme, and they were replaced by guidelines aiming at a stable funding structure.

[6]European banks included in the stress tests exercise conducted by the EBA.

[7]In Portugal four banks were subjected to EBA's rules, namely CGD, Banco BPI, BCP, and ESFG.

this demanding environment banks were forced to adjust their activity strategies.

3.4 Data and descriptive statistics

3.4.1 Data sources

The data set used in this study combines three different micro databases, available at Banco de Portugal, namely Central Credit Register (CRC), Bank Supervisory Data, and the Central Balance Sheet Database.

The CRC contains information on all credit granted by financial intermediaries operating in Portugal. CRC includes information on the outstanding amounts, as well as information regarding credit overdue events for each borrower, among other loan characteristics.[8] Institutions are required to report this information on a monthly basis to Banco de Portugal. Given the low lending threshold required for this report (50 euros), this database affords high coverage of the credit granted by the banking system to the corporate sector. It also allows identifying firm-bank lending relationships at each moment and the exposure of each institution to each firm.

The second database is the Bank Supervisory Data submitted by financial institutions to Banco de Portugal for different reference periods. This database contains financial statements for institutions operating in Portugal and prudential reports for those institutions under supervision of the Portuguese authorities. Note that some institutions, due to their typology, do not report all items.[9] This database allows

[8]For further details on the CRC, see Booklet Nr.5 of Banco de Portugal (Banco de Portugal (2011*a*)).

[9]For instance, subsidiaries of European Union institutions are not required to provide information on capital adequacy ratios to the Portuguese Bank Supervision Authority.

us to obtain several financial and prudential indicators of institutions, which will be important to assess their vulnerability to financial market developments.[10]

For the corporate sector, we use the Simplified Corporate Information (*Informao Empresarial Simplificada* - IES), which was introduced in 2006. IES contains detailed financial data based on accounting reports, as well as other firm characteristics, such as the industry sector, age, and the average number of employees. This information allows us to characterize firms over time. It is noteworthy that IES covers virtually the entire Portuguese corporate sector. This avoids the potential sample bias that voluntary survey may introduce (the approach in place before 2006), and allows us to explore different firm segments.[11]

3.4.2 Data set

For credit institutions we restrict the database to those classified as "Monetary Financial Institutions". Then, we collected balance sheet and profit and loss account data, allowing us to analyze the structure of assets and liabilities of institutions and their respective performance. The detailed data also allow us to determine the weight of sovereign debt securities portfolios. Based on prudential reports, we obtain the capital adequacy ratios.

In CRC, we match borrowers and all respective lenders. We define lending relationships at the banking group level, *i.e.* if a firm borrows from two institutions that belong to the same group, we define it as a single lending relationship. Then, we compute the relevance of each group to each firm, taking into account the share

[10] In this analysis we use data at consolidated level, taking into account that some bank decisions may be defined at the group level (such as specific portfolios).

[11] Before 2006 the Central Balance Sheet Database followed a survey approach, based on economic activity criteria. After 2005, with IES, it covers virtually the entire corporate sector. For further details on the IES databases, see Supplement of Statistical Bulletin (Banco de Portugal (2008)).

of credit provided by each banking group in the firm's total bank debt.

As far as IES data are concerned, we impose some criteria (in line with the procedures followed in the previous Chapters). First, the financial and public administration sectors were excluded. We also excluded observations with missing data for total assets, business volume, number of employees, and age. Furthermore, firms with fewer than five employees were dropped. Moreover, in order to remove outliers, we winsorize the top and bottom two per cent of the distributions of the variables under analysis. Additionally, given the purpose of this study, we collapse the corporate sample to firms that have records on the CRC.[12]

After the merger of the three databases and the application of the criteria, we shrunk the data set to a balanced panel data. We adopted this condition in order to analyze firms that performed their activity over the crisis period. We obtain a data set with around 219,000 firm-year observation for the period 2007-2012.

The balanced panel data implies that all firms grow more mature over the horizon period, which may have some impact on firms' outcomes. For instance, it is not expected that firms continue to present high levels of investment or employment growth over the life cycle. Other assumptions in the definition of the data set could be adopted, leading to an unbalanced panel data. However, that procedure may include other effects and events related to the financial and sovereign debt crises, for instance, the possible relationship between the financial and sovereign debt crises and firms' survival or bankruptcy episodes. The balanced option avoids these events, which are also important issues, but may influence the research question of this study.

[12] At this stage this criterion imposed a reduction of around 85,000 observations in the IES data set.

3.5 Empirical strategy

The empirical strategy adopted in this study proceeds as follows: we characterize credit institutions based on their financial and prudential reports. Then, we match firm-banks and compute a weighted indicator for each firm, based on the financial and prudential position of all firm's lenders. The weights applied correspond to the share of the credit granted by each lender in the firm's total bank debt. In other words, for each firm-year observation we obtain a weighted indicator based on the firm's lending relationships. The weighted scheme intends to control for the dependence of firms on each lender, *i.e.* control for the intensity of each lending relationship. Hereinafter, the weighted indicator is termed *Lenders' Indicator*. Finally, we analyze if there are significant differences in firms' outcomes, exploring firms' lenders' characteristics and the respective heterogeneity, controlling for other firms' characteristics (that may affect the outcomes).

There is no single criterion by which to classify credit institutions' vulnerability to the adverse financial market developments seen during the sovereign debt crisis. Given the nature of the negative shocks, several banks' dimensions are addressed. Due to the tensions in the international financial markets and the value of these funding sources to Portuguese institutions since the establishment of the euro area, we explore variables related to banks' liabilities structure. Therefore, looking at the funding structure, the indicators are related to banks' dependence on financial markets, customers' resources, and money market (variables computed with balance sheet data). We also assess the exposure of each institution to sovereigns by the sovereign debt securities portfolios, given the concerns related to the losses that institutions may incur due to sovereign yields increases. Moreover, we also explore the solvency position, since capital ratios are critical indicators for banks, and they may effectively constrain banks' activity. It is expected that institutions with greater

capital buffers should present a greater ability to absorb unanticipated negative shocks without sizeable constraints on their activity, especially lending.

3.5.1 Variables and summary statistics

This sub-section provides descriptive statistics of variables related to firms and credit institutions included in the analysis.[13]

Table 3.1 displays the composition of firms included in the data set. A significant fraction of the sample corresponds to micro and small firms.[14,15] Firm size can be a relevant indicator in the analysis, as empirical evidence suggests there are differences in the access to external funding by firms' size, usually a proxy for asymmetric information and firms' credit quality. Namely, the empirical literature suggests that smaller firms face greater constraints in obtaining external financing, which may be related to the lack of information available to external agents (less transparent firms), lower diversified activity (so, lower ability to react to unexpected negative shocks), or even lower pledgable assets. These firms are therefore the ones that are potentially more vulnerable to changes in credit supply.

As mentioned, one of the variables of interest in this study is firm's investment. For this, we focus on yearly investment flows. Investment (INVESTMENT) is defined as the flow of investment in tangible and intangible assets of firm i in year t over

[13]Note that due to missing data regarding some components, the number of observations included in the econometric analysis (presented in the next sections) may be slightly different from the figures presented below. However, this fact has not sizeable impact on major descriptive statistics.

[14]Firm size defined in line with the European Commission Recommendation of 6 May 2003 (2003/361/EC), Micro firms are defined as those with fewer than 10 employees and less than 2 million euro of business volume or total assets; Small firms are those with fewer than 50 employees and less than 10 million euro of business volume or total assets; Medium firms are those with fewer than 250 employees and a business volume below 50 million euros or whose total assets is lower than 43 million euros. The remaining firms are considered Large firms.

[15]Recall that in the definition of the data set, we imposed some criteria. We excluded firms with fewer than five employees, which affects the micro segment.

Table 3.1: Sample summary statistics

	Total	**By firm's size:**			
		Micro	Small	Medium	Large
2007	36,457	11,829	20,276	3,684	668
2008	36,457	11,306	20,638	3,825	688
2009	36,457	11,546	20,470	3,782	659
2010	36,457	11,412	20,531	3,832	682
2011	36,457	11,938	20,057	3,772	690
2012	36,457	13,394	18,829	3,582	652
Total	218,742	71,425	120,801	22,477	4,039

the total of those assets at the end of the previous year $(t-1)$.[16] The first columns of Table 3.2 present the path of this variable over the sample period. On average, investment presents a notable decrease in 2009, a year of economic recession in several economies, the Great Depression, after the collapse of Lehman Brothers at the end of 2008. From 2010 on, it continuous a downward trend.[17]

Table 3.2 also presents similar statistics for employment. IES database includes some firm characteristics in addition to financial statements, including the average number of employees. Based on this information we obtain the yearly employment change, which can be interpreted as a proxy for firm's employment decisions. Thus, the employment variable (EMPLOYMENT) corresponds to the change in the average number of employees of firm i in period t over the average number of employees at the end of the previous year $(t-1)$. Broadly, based on mean figures, we observe a downward trend during the period under analysis.

Table 3.3 presents the summary statistics of firm-level variables that may affect firms' decisions. Those variables include profitability, sales growth, size, and the leverage of firms.

[16]The results were very similar when investment was defined based only on tangible assets.

[17]From 2009 to 2010, the significant difference in the average rates should be related to a series break due to changes in IES's reports and accounting rules. Nevertheless, this was a transversal event to all firms included in the sample, so its impact should be captured by time dummies.

Table 3.2: Firm's decisions: investment and employment

	INVESTMENT			**EMPLOYMENT**		
	Mean	Median	Sd	Mean	Median	Sd
2007	0.365	0.090	0.753	0.090	0.000	0.277
2008	0.314	0.103	0.812	0.060	0.000	0.207
2009	0.196	0.086	0.750	0.039	0.000	0.190
2010	0.342	0.041	0.682	0.006	0.000	0.176
2011	0.244	0.085	0.745	0.022	0.000	0.180
2012	0.174	0.044	0.629	-0.002	0.000	0.164

Note: INVESTMENT is defined as the flow of investment in tangible and intangible assets for each in a year over the total of those assets at the end of the previous year. EMPLOYMENT is defined as the change in the average number of employees of each firm in a year over the average number in the previous year. sd stands for standard deviation. The Mean and Median figures are based on the distribution of each variable. Note that there were some changes in the IES report in 2010, which may be underlying the evolution of investment rate between 2009 and 2010.

Profitability (PROFITABILITY) is defined as net earnings before provisions and depreciations over total assets. This variable captures the ability of each firm to generate funds internally, so it may be less dependent on external funding. Sales growth (SALES GROWTH) is the year-on-year change of real sales, and it is meant to control for the firm's growth opportunities.[18] Firm's size (SIZE) is included as the logarithm of total real assets. Size is usually related to asymmetric information and credit quality. The leverage of firms is also an important dimension to control for. We therefore include the bank debt ratio (BANK DEBT), defined as bank debt over total assets.[19]

Looking at financial institutions, Table 3.4 shows some descriptive statistics for different indicators that may identify institutions that are more vulnerable to the adverse financial market conditions, in the context of the sovereign debt crisis. Therefore, the figures correspond to the distribution of the *Lenders' Indicator*, *i.e.* firm's lenders' positions, weighted by the share of each lender in the firm's total bank debt,

[18]In empirical research, firm's growth opportunities are usually controlled through measures related to firm's market value. However, this approach is not possible to implement in the Portuguese case, as the share of quoted firms is very small.

[19]The definition of each variable for firms is presented in Table III.1 in the Appendices Section of this Chapter. Table III.2 presents summary statistics for some other firm characteristics included in the data set.

Table 3.3: Sample summary statistics - Firm characteristics

	Nr.	Mean	Sd	p10	p25	p50	p75	p90
SIZE	211,741	13.78	1.45	12.11	12.82	13.63	14.58	15.63
PROFITABILITY	211,752	0.09	0.12	-0.01	0.04	0.09	0.14	0.22
SALES GROWTH	211,747	-0.03	0.26	-0.32	-0.14	-0.02	0.09	0.24
BANK CREDIT	211,752	0.66	0.31	0.30	0.47	0.66	0.81	0.93

Note: sd stands for standard deviation, while p10, p25, p50, p75, and p90 stand for the percentiles 10, 25, 50, 75, and 90, respectively, of the distribution of each variable, for observations included in the econometric analysis.

in the sample period.[20]

Concerning lenders' funding structure, the set of indicators includes the central bank funding (CENTRAL BANK), defined as central bank liabilities over total assets, interbank funding (INTERBANK), which corresponds to interbank market liabilities over total assets, and the funding in financial markets (MARKET FUNDING), defined as the wholesale debt and interbank funding over total assets. It also comprises the relevance of customers' resources, through the ratio of customers' deposits over total assets (DEPOSITS_A), and loans over customers' deposits (LOAN-TO-DEPOSIT).

We expect to see a positive relationship between the levels of interbank and financial markets indicators and the lenders' vulnerability to market developments. Higher shares of these funding sources correspond to greater dependence on financial markets, and consequently institutions may be more exposed to the adverse developments and conditions recorded in those markets during the horizon period. For the loans-to-deposits ratio a similar rationale applies: a higher ratio means that the bank uses funding resources rather than customers' deposits (perceived as more stable funding source) to finance their lending activity.[21] In line with this percep-

[20]The definitions underlying each variable are presented in Table III.3 in the Appendices Section. Table III.4 presents the correlation matrix between firms' decisions and lenders' indicators.

[21]Indeed, in Portugal even during the crisis, customers' deposits presented a positive path, which reflected customers' confidence in the Portuguese financial system. At aggregate level customers' deposits in the Portuguese banking system increased by around 15 per cent from 2008 to 2012, mainly since 2010.

tion, a negative relationship is also expected between deposit-to-assets and bank's vulnerability to financial market events. For the central bank indicator, during the sample period there is no clear "*a priori*" expectation. On one hand, the relationship may be positive, given that the ECB was crucial as a lender of last resort. On the other, since it may also identify banks' liquidity needs, the relationship may have the opposite sign. The central bank was an important funding source in the period, due to the constraints in access to alternative finance sources faced by institutions.

Concerning the sovereign exposures (the indicator most used in the recent empirical literature), we assess the total sovereign debt securities (SOVEREIGN), as the ratio of sovereign debt securities portfolio over total assets, and the Portuguese sovereign debt securities (PT SOVEREIGN), which corresponds to the Portuguese sovereign debt securities over total assets. Given the tensions in the euro area sovereign debt markets and the extreme increases in sovereign bond yields, institutions with greater sovereign exposures may be assessed as more vulnerable (which is in line with the EBA's decision about the "*Sovereign capital buffer*" in 2011). For these institutions, the bank-sovereign linkage is expected to be more important.

Finally, for the solvency position, the analysis takes into account the Total capital ratio (CAPITAL RATIO), *i.e.* the total regulatory capital over risk weighted assets. It also includes the Tier 1 capital ratio (TIER 1 RATIO), defined as the Tier 1 capital over risk-weighted assets, which became more relevant after the onset of the crisis. Based on capital ratios, institutions can be seen as weaker, *i.e.* more vulnerable, if they present ratios close to the legal threshold. This means that those institutions have lower capital to absorb unexpected negative shocks. Therefore, they have lower ability to react to those shocks without restrictions on their activity (and) or increases in their regulatory capital levels.

Table 3.4: Descriptive statistics - Lenders' Indicators

	Nr.	Mean	Sd	p10	p25	p50	p75	p90
Funding structure:								
CENTRAL BANK	211,752	0.05	0.04	0.00	0.02	0.04	0.08	0.12
INTERBANK MARKET	211,752	0.11	0.12	0.03	0.05	0.08	0.12	0.24
MARKET FUNDING	211,752	0.27	0.13	0.13	0.20	0.27	0.35	0.44
DEPOSITS_A	211,752	0.45	0.13	0.30	0.38	0.45	0.51	0.60
LOAN-TO-DEPOSIT	211,752	2.31	11.20	0.86	1.05	1.29	1.56	1.85
Debt securities portfolio:								
PT SOVEREIGN	211,752	0.03	0.03	0.00	0.01	0.03	0.05	0.06
SOVEREIGN	211,752	0.04	0.03	0.01	0.02	0.04	0.05	0.07
Solvency:								
TIER 1 CAPITAL	211,752	0.07	0.05	0.05	0.06	0.08	0.09	0.11
TOTAL CAPITAL	211,752	0.09	0.05	0.06	0.09	0.10	0.11	0.12

Note: sd stands for standard deviation, while p10, p25, p50, p75, and p90 stand for the percentiles 10, 25, 50, 75, and 90, respectively, of the distribution of each indicator. The *Lenders' Indicator* corresponds to a weighted indicator at firm level, based on share of each lender on firm's total bank debt.

3.6 Empirical results

3.6.1 Empirical specification

The empirical strategy explores firms' decisions conditioned on their lenders' vulnerability to the adverse developments recorded in the financial markets. Therefore, in this Section, we run the following reduced-form specification:

$$y_{i,t} = c + \alpha X_{i,t-1} + \delta z_i + \phi w_t + \beta_1 LI_{i,t-1} + \beta_2 LI_{i,t-1} \times Crisis + \mu_{i,t} \tag{3.1}$$

where the left-hand-variable, $y_{i,t}$, corresponds to the decision of firm i in period t, namely investment or employment decisions. $X_{i,t-1}$ is a vector of firm-specific variables that may affect a firm's decisions, measured at $t-1$.[22] z_i corresponds to the firm's time-invariant components. The firm fixed-effects control for unobserved firm

[22]The inclusion of control variables with a lag period avoids the contemporaneous effect between firm's characteristics and its decisions.

characteristics that are unchanged over time. w_t represents year dummies, which control for changes in the general macroeconomic and financial environment that affect all firms simultaneously. LI is the *Lenders' Indicator*, the variable that characterizes the position of all firms' lenders. $LI_{i,t-1}$ reflects firm i's lenders' position, based on the criterion under analysis, at $t-1$. The specification also includes an interaction term between this variable and the time dummy variable $Crisis$, that takes the value one for the period after the onset of the euro area sovereign debt crisis, *i.e.* after 2009 ($LI_{i,t-1} \times Crisis$). Finally, $\mu_{i,t}$ corresponds to the error term.

Based on equation 3.1, we are interested in the sign of the β_2 coefficient, as it allows us to know if the sensitivity of firms' decisions to lenders' characteristics changed after 2009, when banks suffered the negative shock related to the outbreak of the euro area sovereign debt crisis, and the spillovers to Portuguese agents and economy.

As the specification includes fixed-effects at firm level, the identification comes from the comparison within firms' changes in employment and investment, for firms that borrow from lenders with different exposures to the crisis. Moreover, due to the specificities of the data set, the econometric procedure includes robust standard errors.

3.6.2 Econometric results

i) Investment decisions

As mentioned, the purpose of this study is to explore if firms that have relationships with lenders more vulnerable to the adverse environment, *i.e.* subject to higher challenges during the sovereign debt crisis and the adverse financial market developments, present significant differences in their decisions. In this section, we focus

on investment outcomes.

Investment is an important component for firm's prospects, and, at the aggregate level, it is closely related to economic growth. In fact, as shown in Amador & Coimbra (2007) and Almeida & Félix (2006), capital stock developments have made an important contribution to Portuguese economic growth in the past few decades. More recently, the low performance of the Portuguese economy has been linked to a strong fall in investment.[23] In general, investment is fundamental in determining the future productive capacity and economic growth in the long-run (*e.g.* King & Levine (1993)).

As mentioned above, we explore alternative indicators to characterize firm's lenders' position regarding funding structure, sovereign credit risk exposure, and solvency. We also control for the importance of each lender in the firm's total bank debt, which allows us to control for the dependence of the firm on each lender. The higher is the dependence of firms on lenders identified as potentially more vulnerable to the adverse market conditions, we expect that those firms face higher constraints, *ceteris paribus*. This is in line with hold-up issues and switching costs related to bank lending relationships, *i.e.* it may not be easy for firms to change lenders. Indeed, in the context of the financial crisis, Ivashina & Scharfstein (2010) found evidence that borrowers from weaker banks could not switch to healthier banks. It is also linked to the empirical evidence toward adjustments in credit supply during crisis periods, as shown by Chodorow-Reich (2014), Iyer et al. (2014), and Bofondi et al. (2013).

Table 3.5 presents the results of equation 3.1 for investment. Each column of the table corresponds to one of the alternative indicators that underlies the characterization of firm's lenders' vulnerability. For instance, the first five columns of the

[23]Note that the concept of investment at aggregate level may not match with the investment measures computed at the micro level.

table present the results exploring the five funding structure criteria.

According to the results obtained, the coefficient of interbank funding is negative and statistically significant. The interaction term with the crisis dummy also has a negative and statistically significant coefficient. These results suggest that the firms whose lenders had a higher dependence of this funding source presented a poorer path for investment, and this effect was intensified after 2009. Looking at market funding, the interaction term also shows a statistically significant and negative coefficient. This result is in line with the constraints in the access to the wholesale debt markets that banks faced in that period, and the tensions in the interbank market. The deposits-to-asset ratio has a statistically significant coefficient for the interaction term, but with a negative sign. This result contradicts the *a priori* expectations, given that a higher ratio corresponds to lower dependence on alternative funding sources (rather than deposits) to finance lending operations. The coefficients of the other funding indicators are not statistically significant in this approach.

As far as lenders' sovereign debt securities are concerned, in columns 6 and 7, the empirical evidence does not suggest impacts on firm's investment. The coefficients of total sovereign debt securities portfolio, and the Portuguese sovereign debt securities holdings, are not statistically significant.

Columns 8 and 9 present the results based on Tier 1 and Total capital ratios, respectively. According to the estimates, there is no statistically significant impact on firm's investment influenced by lenders' capital ratios.

Summing up The empirical evidence suggests that the main dimension that affect a firm's investment decision is related to the funding structure of their lenders. Broadly, according to the results, firms whose lenders depend more on funding

obtained in the financial and interbank markets present lower investment after 2009, in comparison with the previous years. We find that, on average, a one standard-deviation increase in lenders' interbank funding leads to around 0.7 percentage points additional decline in firm's investment after the outbreak of the crisis.

The importance of lenders' funding structure is in line with Cingano et al. (2013), who also explored lenders' funding sources, even though during the financial crisis. However, these results are unlike those in De Marco (2016), who explored the sovereign debt crisis based on banks' exposures to sovereigns. However, the analysis was based on syndicated loans, which are usually biased to larger firms, and consequently may have influence in the analysis.

Firm control variables Finally, all firms' control variables included in the specifications (the $X_{i,t-1}$ vector) are statistically significant and present the expected sign. This confirms that firm characteristics are also important factors underlying firms' investment. In particular, SIZE shows a negative coefficient, suggesting that larger firms tend to present lower investment, which should be in line with the firm's life cycle (*i.e.* typically investment is stronger in initial phases of firms). SALES GROWTH, a variable that seeks to capture the potential growth, shows a positive coefficient. This suggests that corporate investment is sensitive to the demand for firms' products and opportunities to expand. Additionally, firms with higher indebtedness level (BANK DEBT) tend to present lower investment in the following year. A possible reason for this result may be the fact that firms with higher debt ratios tend to face higher financial constraints. In turn, PROFITABILITY presents a positive and statistically significant coefficient. This suggests that firms use part of internal funds for investment (which is in line with the "*pecking order theory*" of Myers (1984), arguing an optimal hierarchy for funding).

Table 3.5: Firms' investment decisions

	Funding structure					Sovereign exposure		Solvency	
	1	2	3	4	5	6	7	8	9
LI:	Central bank	Interbank	Market	Dep_A	LTD	Sovereign	PT Sovereign	Tier 1 Capital	Total capital
LI_{t-1}	0.1845	-0.0659**	-0.0582**	0.0403	-0.0010	0.4398	-0.0297	-0.0911	-0.0840
	(1.07)	(-2.02)	(-2.01)	(1.47)	(-1.57)	(1.20)	(-0.11)	(-1.04)	(-0.97)
LI_{t-1}*CRISIS	-0.1272	-0.0627**	-0.0689**	-0.0591**	-0.0004	-0.4451	-0.0333	0.0053	-0.0235
	(-0.73)	(-1.96)	(-2.31)	(-2.15)	(-0.62)	(-1.33)	(-0.13)	(0.06)	(-0.29)
PROFITABILITYt-1	0.0793***	0.0807***	0.0802***	0.0792***	0.0802***	0.0794***	0.0791***	0.0794***	0.0795***
	(3.22)	(3.27)	(3.25)	(3.21)	(3.25)	(3.22)	(3.21)	(3.22)	(3.22)
SALES GROWTHt-1	0.1051***	0.1046***	0.1047***	0.1050***	0.1049***	0.1050***	0.1050***	0.1050***	0.1050***
	(14.54)	(14.48)	(14.50)	(14.53)	(14.52)	(14.53)	(14.54)	(14.54)	(14.54)
SIZEt-1	-0.5163***	-0.5154***	-0.5161***	-0.5165***	-0.5162***	-0.5164***	-0.5165***	-0.5165***	-0.5165***
	(-49.70)	(-49.59)	(-49.69)	(-49.64)	(-49.69)	(-49.70)	(-49.69)	(-49.72)	(-49.73)
BANK DEBTt-1	-0.3935***	-0.3930***	-0.3945***	-0.3962***	-0.3943***	-0.3947***	-0.3946***	-0.3941***	-0.3943***
	(-22.74)	(-22.72)	(-22.80)	(-22.81)	(-22.80)	(-22.74)	(-22.73)	(-22.79)	(-22.80)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm-fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	211,752	211,752	211,752	211,752	211,752	211,752	211,752	211,752	211,752
R^2	0.0520	0.0521	0.0521	0.0520	0.0522	0.0520	0.0520	0.0520	0.0520

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The econometric models include firm-fixed effects and robust standard errors. All regressions include a constant term. Each column corresponds to an alternative criterion to classify firms' lenders as more vulnerable to sovereign debt crisis and its consequences (*i.e.* more vulnerable institutions). The dependent variable is INVESTMENT, defined as the flow of investment in tangible and intangible assets for each firm in a year over the total of those assets at the end of the previous year. Looking at the independent variables, PROFITABILITY is defined as net earnings before provisions and depreciation over total assets; SALES GROWTH is defined as year-on-year change rate of sales; SIZE is based on the natural logarithm of real total assets; BANK DEBT defined as debt over total assets. $LI_{i,t-1}$ is the interaction term between the firm-lenders indicator under analysis in each column and the weight of each lender in firm's debt. $LI \times Crisis$ corresponds to the interaction between the previous variable and the dummy variable that identifies the period after 2010 (2010 to 2012).

ii) Employment decisions

Funding is important for investment decisions, but also for other dimension of firms' activity. Therefore, we perform an analysis similar to that conducted above, but exploring firm's employment decisions. Indeed, employment is also an important firm decision.

Employment can be seen as a complementary input to production, due to the usual complementarity of physical capital and human resources in the production function. However, if firms face financial difficulties, they may also adjust this factor *per se* to levels more consistent with firms' current financial position. As described in the literature section, some papers reported evidence that firms adjust employment after a shock that affected their lenders negatively, for instance, the findings of Chodorow-Reich (2014) in the US, Bentolila et al. (2015) for Spanish firms, and Bottero et al. (2015) for smaller firms in Italy.

IES includes the average number of employees for each firm. Based on this information, we explore the potential impact of lenders' exposure to the crisis on firms' employment decisions. The econometric results for this analysis are presented in Table 3.6. The structure of this table follows the previous one, so each column corresponds to the alternative indicator used to characterize institutions potentially more vulnerable to the adverse financial market developments, during the sovereign debt crisis.

For lenders' funding structure, in general, firms whose lenders are more dependent on the financial market tend to present a higher adjustment in the number of employees. In particular, the coefficients of interbank and market funding indicators are negative and statistically significant after 2009. The analysis based on deposits-to-assets ratio presents a positive coefficient after the onset of the sovereign

debt crisis. This result suggests that firms whose lenders finance their activity more intensively by customers' resources present a more favorable employment path, reinforcing the previous findings regarding market funding. The estimates for the remaining indicators related to lenders' liabilities are not statistically significant.

When we characterize institutions based on sovereign debt securities portfolios, both criteria (total sovereign and Portuguese sovereign securities) present positive coefficients in the period after the outbreak of the euro area sovereign debt crisis. If we expect that higher exposures imply higher risk for institutions, and consequently (negative) "differentiation" by investors in financial markets, these results are somewhat puzzling. However, this may be related to the general position of these institutions. Note that before the unexpected Greek bailout, sovereign debt securities were perceived as safe assets, and in that period the returns were high.

Based on the regulatory capital position, the Tier I and Total capital ratios are not statistically significant.

In terms of magnitudes, the estimates obtained indicate that, on average, firm's employment decreases by 0.3 percentage points based on a one standard-deviation increase in lender's market funding, after the onset of the sovereign debt crisis. In turn, a one standard deviation increase in the lenders' sovereign portfolio leads to an increase by around 0.6 percentage points in firm's employment changes.

All in all, looking at firms' employment decisions, the results are broadly in line with those observed for investment as far as lenders' funding position is concerned. However, in this analysis the results suggest that some other lenders' characteristics may also play a role on firms' employment, namely the sovereign debt securities portfolios.

Table 3.6: Firms' employment decisions

	Funding structure					Sovereign exposure		Solvency	
	1	2	3	4	5	6	7	8	9
LI:	Central bank	Interbank	Market	Dep_A	LTD	Sovereign	PT Sovereign	Tier 1 Capital	Total capital
LI_{t-1}	-0.0474	0.0059	0.0030	-0.0123*	0.0003*	-0.1408	-0.0994	0.0313	0.0345
	(-1.08)	(0.76)	(0.41)	(-1.80)	(1.85)	(-1.39)	(-1.42)	(1.39)	(1.57)
LI_{t-1}*CRISIS	0.0445	-0.0184**	-0.0252***	0.0176**	-0.0001	0.1949**	0.1435**	-0.0160	-0.0258
	(1.00)	(-2.35)	(-3.40)	(2.52)	(-0.88)	(2.10)	(2.22)	(-0.75)	(-1.25)
PROFITABILITYt-1	0.0809***	0.0811***	0.0811***	0.0810***	0.0808***	0.0810***	0.0810***	0.0809***	0.0809***
	(12.94)	(12.96)	(12.96)	(12.94)	(12.93)	(12.94)	(12.94)	(12.94)	(12.94)
SALES GROWTHt-1	0.0367***	0.0367***	0.0367***	0.0368***	0.0368***	0.0368***	0.0368***	0.0367***	0.0367***
	(17.35)	(17.34)	(17.35)	(17.37)	(17.37)	(17.36)	(17.36)	(17.36)	(17.36)
SIZEt-1	-0.0418***	-0.0417***	-0.0417***	-0.0417***	-0.0418***	-0.0417***	-0.0417***	-0.0417***	-0.0418***
	(-19.48)	(-19.43)	(-19.47)	(-19.44)	(-19.49)	(-19.45)	(-19.44)	(-19.47)	(-19.48)
BANK DEBTt-1	-0.0389***	-0.0386***	-0.0387***	-0.0382***	-0.0387***	-0.0382***	-0.0383***	-0.0388***	-0.0388***
	(-8.88)	(-8.83)	(-8.85)	(-8.70)	(-8.85)	(-8.71)	(-8.73)	(-8.87)	(-8.86)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm-fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	212,288	212,288	212,288	212,288	212,288	212,288	212,288	212,288	212,288
R^2	0.0396	0.0397	0.0397	0.0397	0.0397	0.0397	0.0397	0.0396	0.0396

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The econometric models include firm-fixed effects and robust standard errors. All regressions include a constant term. Each column corresponds to an alternative criterion to classify firms' lenders as more vulnerable to sovereign debt crisis and its consequences (*i.e.* more vulnerable institutions). The dependent variable is EMPLOYMENT, defined as change in the average number of employees for each firm in a year over the average number of employees at the end of the previous year. Looking at the independent variables, PROFITABILITY is defined as net earnings before provisions and depreciation over total assets; SALES GROWTH is defined as year-on-year change rate of sales; SIZE is based on the natural logarithm of real total assets; BANK DEBT defined as debt over total assets. $LI_{i,t-1}$ is the interaction term between the firm-lenders indicator under analysis in each column and the weight of each lender in firm's debt. $LI \times Crisis$ corresponds to the interaction between the previous variable and the dummy variable that identifies the period after 2010 (2010 to 2012).

3.6.3 Firms' decisions sensitivity over time

In this sub-section we replace the iteration term between the *Lenders' Indicator* and the crisis dummy in equation 3.1, by interaction terms between $LI_{i,t-1}$ and the year dummies variables, w_t. This specification allows us to observe how the impact of lenders' characteristics changes year by year on firms' decisions. Thus, we run the following specification:

$$y_{i,t} = c + \alpha X_{i,t-1} + \delta z_i + \phi w_t + \beta_1 LI_{i,t-1} + \beta_{2,t} LI_{i,t-1} \times w_t + \mu_{i,t} \tag{3.2}$$

Again, $y_{i,t}$ corresponds to investment or employment decisions of firm i in period t. $X_{i,t-1}$ is the vector of firm-specific variables at $t-1$, while z_i corresponds to firm time-invariant characteristics. w_t corresponds to year dummy variables. $LI_{i,t-1}$ is the indicator that characterizes lenders of firm i at period $t-1$. $LI_{i,t-1} \times w_t$ corresponds to the interaction term between lenders' characteristics and the year dummies. $\mu_{i,t}$ represents the error term.

In this specification we are interested in the sign and path of $\beta_{2,t}$ coefficients. These coefficients, in line with the previous specification, allow us to identify the impact of firms' lenders' position on firms' decisions. Additionally, we can check to see if this effect changed over the sample period. The results for this specification are presented in Tables III.5 and III.6 in the Appendices Section of this Chapter, for investment and employment decisions, respectively.

i) Investment decisions

For investment, we confirm the relevance of firm's lenders' funding structure indicators, mainly interbank and market funding. Based on the dependence on interbank funding, the coefficients of some interaction terms are negative and statistically sig-

nificant. The negative coefficient in 2009 should reflect the tensions in financial markets following the Lehman Brothers' bankruptcy, which implied a collapse of the interbank market worldwide. The coefficients are also negative and statistically significant in 2011 and 2012, showing higher magnitudes. This suggests an intensification of this lenders' characteristic during the sovereign crisis. In turn, looking at market funding, the interaction terms are statistically significant, with negative coefficients, only in 2011 and 2012, when tensions spread to several financial markets. These results are in line with the constraints that banks faced in that period after the onset of the sovereign debt crisis. The sovereign debt securities portfolios and the prudential capital positions remain statistically non-significant in this approach.

ii) Employment decisions

For employment, the results also confirm the relevance of lenders' liabilities structure. Based on the interbank indicator, all the coefficients are statistically significant. This suggests that this dependence could have been stricter to banks as the crisis lasts. A similar effect is observed for the market funding indicator. In this analysis, deposits-to-assets is also statistically significant, with positive coefficients, in the last year under analysis. This may be related to significant changes recorded in this period, in particular active policies adopted by banks to capture customers' deposits, in line the guidelines defined in the Programme to the loan-to-deposits ratio. Indeed, in the beginning of the Portuguese Programme, there was a sizable decrease of this ratio through deposits effects, rather than a significant cut in lending activity. The sovereign exposures present statistically and significant coefficients in 2012, with a positive sign. The capital ratios' coefficients are positive and statistically significant in 2009 and 2012.

3.7 Alternative Approach

In this Section we intend to answer the same research question: are firm's decisions conditioned on their lenders' vulnerabilities to the sovereign debt crisis? However, we adopt an alternative empirical approach to estimate the impact of the negative shock due to the unexpected bailout of a euro area country, and its the spillovers to other countries and financial markets. In particular, in this section we explore the firm-lenders relationships at the moment precisely before the onset of the sovereign debt crisis, namely at the end of 2009. In turn, for firms' outcomes, we focus the analysis on the investment and employment average figures, before and after the onset of the crisis.

3.7.1 Alternative empirical specification

The empirical procedure of this alternative approach is similar to that followed in previous sections. Therefore, taking into account firm-bank relationships and lenders' position at the end of 2009, we compute the weighted indicator for each firm. Then, based on firms' lenders' heterogeneity, we compare the path of average investment and employment changes in the period before the outbreak of the crisis and the period after it (pre-crisis *versus* crisis). For the period before the sovereign debt shock we considered the average investment and employment based on 2008 and 2009 figures, while for the period after the shock the average variables are based on 2011 and 2012 figures.

In this section we run the following specification:

$$y_{i,t} = c + \alpha X_{i,t-1} + \delta z_i + \phi Crisis + \beta LI_{i,09} \times Crisis + \mu_{i,t} \tag{3.3}$$

where $y_{i,t}$ corresponds to the average investment or average employment of firm i in the period t: 2008/2009 and 2011/2012. $X_{i,t-1}$ is a vector of firm-specific variables that may affect the firm's decisions evaluated at $t-1$ (namely 2007 and 2010). z_i corresponds to the firm's time-invariant components, while $Crisis$ is a time dummy variable that takes the value one for the period after 2009. In this specification $LI_{i,09}$ is the *Lenders' Indicator* that characterizes all lenders' positions of firm i at the end of 2009. Finally, $\mu_{i,t}$ corresponds to the error term.

In this framework the coefficient of interest is β, which corresponds to the interaction term between the *Lenders' Indicator* and the time dummy *Crisis*. The sign and significance of the β coefficient allows us to check if there were differences in the firm's decisions depending on its lenders' vulnerabilities to the negative shock recorded in mid-2010. So, we test if firms whose pre-crisis lenders were more vulnerable presented higher or lower changes from the period before to the period after the onset of the sovereign debt crisis.

Given that the key coefficient reflects the interaction between the time dummy and the *Lenders' Indicator*, which is a continuous variable, we can find some similarities between this specification and those that exploit treatment intensity variables. Exploring firms variation, the set of firms whose lenders present better indicators (*i.e.* lower vulnerability to the crisis) can be defined, by analogy, as the control group. In some way, this approach is in line to the analysis conducted by Acemoglu & Lyle (2004) about the impact of World War II on the women's labor market in the US. The authors explored the *"mobilization rate"* of men to the war as the key differential variable, given that this rate was not uniform across states (*i.e.* the share of men recruited in each state). So, they explored a continuous treatment variable rather than the usual binary variable approach.[24]

[24]For additional details and discussion about treatment intensity variables, see the Chapter "Parallel worlds: fixed effects, differences-in-differences, and panel data" in Angrist, Joshua D and Pischke, Jörn-Steffen (2008).

In this framework, it is worth highlighting some facts. As mentioned, the key variable under analysis is defined based on lenders' positions at the end of 2009 ($LI_{i,09}$). This position is defined after some firms' decisions had taken place. However, this fact should not invalidate the results as long as the events were unexpected at the time. In other words, before 2010 firms could not anticipate the onset of the sovereign debt crisis and the tensions in the international financial markets, or the consequences of these developments to their lenders. The same applies to financial institutions, *i.e.* institutions' decisions and financial positions at the end of 2009 did not reflect the coming events. Both arguments seem reasonable in the setup under analysis. Actually, the Greek bailout, *i.e.* the bailout of a euro area country, was not expected by agents and it changed considerably the assessment of sovereign credit risk by investors and the dynamics in international financial markets. Moreover, this approach allows us to exclude from the analysis potential effects related to lenders' decisions driven by the changes in the economic and financial environment, following the Greek bailout.

Lenders' characteristics

In this approach, we continue exploring the indicators used in the previous section to characterize banking institutions. However, as we characterize firm's lenders only at the end of 2009, we include some additional indicators in the analysis. These indicators allow us to explore other dimensions that may help to characterize banks' vulnerability to the crisis or their potential ability to overcome the adverse market conditions.

Based on the prudential liquidity reports, we obtain information about the liquidity position of each institution, such as the liquidity gap. This indicator takes into account the maturity (mis)match between assets and liabilities for different

time windows. In this analysis we consider the liquidity gap for 6 to 12 months. This indicator therefore identifies the funding needs for the second half of 2010, the semester following the Greek rescue.

As financial markets dried up for Portuguese institutions during 2010, funding from the central bank, the lender of last resort, was crucial for some institutions to overcome liquidity shocks during this period. As presented in Figure III.3, in the Appendices Section, a sizable increase in credit from ECB operations occurred in mid-2010. However, gaining access to these operations requires pledging collateral. Therefore, we include in the analysis a variable related to the availability of assets eligible for monetary operations, *i.e.* assets that could be pledged as collateral in monetary operations conducted by the ECB, if needed.[25]

A negative liquidity gap, LIQUIDITY GAP, means that liabilities with maturity between 6 and 12 months are higher than the assets with similar maturity. The indicator ELIGIBLE ASSETS was defined as the share of assets that can be pledged as collateral in monetary operations over total assets. Based on these indicators, we expect that institutions showing higher indicators should be in a better position to face the negative shock recorded in 2010.

Table 3.7 presents some descriptive statistics for *Lenders' Indicators* (in line with the analysis of Table 3.4), assessed at the end of 2009 and including the additional variables.

[25]This key indicator is available only since 2009, with the introduction of new items in the prudential liquidity report.

Table 3.7: Descriptive statistics - Lenders' Indicators at end-2009

	Nr.	Mean	Sd	p10	p25	p50	p75	p90
Funding structure:								
CENTRAL BANK	36,408	0.04	0.01	0.02	0.03	0.04	0.04	0.05
INTERBANK MARKET	36,408	0.11	0.10	0.04	0.06	0.08	0.12	0.21
MARKET FUNDING	36,408	0.31	0.12	0.18	0.26	0.30	0.38	0.46
DEPOSITS_A	36,408	0.43	0.13	0.29	0.34	0.42	0.49	0.54
LOAN-TO-DEPOSIT	36,408	1.42	2.47	0.91	1.16	1.33	1.50	1.79
LIQUIDITY GAP	36,408	-10.00	11.27	-19.60	-12.43	-9.66	-6.34	-1.99
Debt securities portfolio:								
PT SOVEREIGN	36,408	0.02	0.02	0.00	0.01	0.02	0.03	0.04
SOVEREIGN	36,408	0.03	0.02	0.01	0.02	0.03	0.04	0.05
Collateral:								
ELIGIBLE ASSETS	36,408	0.10	0.04	0.06	0.07	0.10	0.11	0.17
Solvency:								
TIER 1 CAPITAL	36,408	0.07	0.05	0.04	0.07	0.08	0.09	0.10
TOTAL CAPITAL	36,408	0.09	0.05	0.06	0.09	0.11	0.11	0.12

Note: sd stands for standard deviation, while p10, p25, p50, p75, and p90 stand for the percentiles 10, 25, 50, 75, and 90, respectively, of the distribution of each indicator. The *Lenders' Indicator* corresponds to a weighted indicator at firm level, based on share of each lender on firm's total bank debt.

3.7.2 Econometric results

Tables 3.8 and 3.9 present the results of this alternative approach for firms' investment and employment decisions, respectively. The new indicators are presented in the last two columns of each table.

As mentioned, the β coefficient in equation 3.3 is the key variable in this approach. Due to the characteristics of the data set, the econometrics procedure includes robust standard errors.

i) Investment decisions

Looking at funding structure, only the specifications with interbank and market funding indicators present statistically significant coefficients, with negative signs.

These results suggest that firms whose lenders were more dependent on these funding sources at the end of 2009 presented lower (average) investment after 2010. The sovereign exposures and solvency indicators remained statistically non-significant in this set up.

Looking at the new indicators, the coefficient of the variable related to liquidity gap, presented in column 10, is not statistically significant. The availability of assets eligible as collateral, column 11, presents a positive and statistically significant coefficient for the interaction term with the crisis dummy. This suggests higher average investment for firms whose lenders showed greater ability, assessed at the end of 2009, to gain access to the ECB operations.

According to the results obtained, a one standard deviation increase in lenders' market funding corresponds to a reduction of 0.7 percentage points in average investment between the period before and after the onset of the sovereign crisis. A change of similar magnitude in lenders' eligible assets indicator has approximately the inverse impact.

ii) Employment decisions

Concerning employment decisions, and looking at lenders' liabilities structure, interbank lending, market funding, and the deposits-to-assets ratio are statistically significant. The last presents a positive coefficient while the other two indicators show negative signs. Therefore, average employment changes show less favorable path for firms whose lenders were more dependent on financial markets (or with lower share of customers' deposits) at the end of 2009.

Under this framework the indicators related to banks' exposure to sovereign debt securities continue presenting positive coefficients, *i.e.* firms whose lenders have

Table 3.8: Alternative approach: Firms' investment

	Funding structure					Sovereign exposure		Solvency		Funding	Collateral
	1	2	3	4	5	6	7	8	9	10	11
LI_{09}:	Central bank	Interbank	Market	Dep_A	LTD	PT Sovereign	Sovereign	Tier 1 Capital	Total capital	Liq. Gap	Elegible A
LI_{09}*CRISIS	0.2729	-0.0811**	-0.0604**	-0.0124	-0.0016	0.1716	0.3287	-0.0493	-0.0613	-0.0002	0.1570*
	(1.08)	(-2.35)	(-2.08)	(-0.47)	(-0.77)	(0.84)	(1.57)	(-0.66)	(-0.88)	(-0.59)	(1.92)
PROFITABILITYt-1	-0.0116	-0.0110	-0.0114	-0.0116	-0.0116	-0.0122	-0.0126	-0.0113	-0.0112	-0.0114	-0.0131
	(-0.35)	(-0.33)	(-0.34)	(-0.34)	(-0.34)	(-0.36)	(-0.37)	(-0.34)	(-0.33)	(-0.34)	(-0.39)
SALES GROWTHt-1	0.0917***	0.0918***	0.0920***	0.0917***	0.0917***	0.0918***	0.0918***	0.0918***	0.0918***	0.0918***	0.0916***
	(8.08)	(8.08)	(8.10)	(8.08)	(8.08)	(8.08)	(8.09)	(8.08)	(8.08)	(8.08)	(8.07)
SIZEt-1	-0.4301***	-0.4303***	-0.4307***	-0.4305***	-0.4304***	-0.4303***	-0.4299***	-0.4305***	-0.4305***	-0.4303***	-0.4299***
	(-37.43)	(-37.47)	(-37.51)	(-37.46)	(-37.49)	(-37.48)	(-37.43)	(-37.48)	(-37.49)	(-37.48)	(-37.42)
BANK DEBTt-1	-0.4284***	-0.4278***	-0.4278***	-0.4288***	-0.4282***	-0.4278***	-0.4273***	-0.4280***	-0.4281***	-0.4278***	-0.4284***
	(-20.33)	(-20.34)	(-20.33)	(-20.19)	(-20.34)	(-20.34)	(-20.32)	(-20.34)	(-20.35)	(-20.33)	(-20.36)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Crisis dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm-fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	86,102	86,102	86,102	86,102	86,102	86,102	86,102	86,102	86,102	86,102	86,102
R^2	0.0913	0.0914	0.0913	0.0912	0.0913	0.0913	0.0913	0.0912	0.0913	0.0912	0.0913

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The econometric models include firm-fixed effects and robust standard errors. All regressions include a constant term. Each column corresponds to an alternative criterion to classify firms' lenders as more vulnerable to sovereign debt crisis and its consequences (*i.e.* weaker institutions). The dependent variable is INVESTMENT, defined as the flow of investment in tangible and intangible assets for each firm in a year over the total of those assets at the end of the previous year. Looking at the independent variables, PROFITABILITY is defined as net earnings before provisions and depreciation over total assets; SALES GROWTH is defined as year-on-year change rate of sales; SIZE is based on the natural logarithm of real total assets; BANK DEBT defined as debt over total assets. $LI_{i,09}$ is the interaction term between the firm-lenders indicator under analysis in each column and the weight of each lender in firm's debt at end-2009. $LI_{i,09} \times Crisis$ corresponds to the interaction between the previous variable and the dummy variable that identifies the period after 2010.

higher sovereign debt securities holdings at the end of 2009 tend to reveal more favorable employment changes over time. Looking at capital adequacy ratios, the results do not suggest an impact on the average employment changes.

In line with the results observed for investment, the liquidity gap is not statistically significant. The variable eligible assets presents a positive coefficient. This suggests that banks with greater capacity to borrow from the Central Bank, measured by the assets available to pledge as collateral in monetary operations, are in a more favorable position to overcome adverse financial market developments.

The results indicate that firm's average employment change decreases by around 0.2 percentage points for a one standard-deviation increase in lenders' market funding. In turn, a one standard-deviation increase in lenders' sovereign securities portfolio or in eligible assets indicator implies an increase by around 0.24 percentage points in firm's average employment change.

Summing up In this analysis we explore the exposure of firms to adverse shocks through their lenders' positions defined at the end of 2009, before the onset of the sovereign debt crisis. In this Section, in particular, as the key variable is continuous and we analyze firm's outcomes in two periods (pre-crisis *versus* crisis), we can differentiate firms among those with high and low exposures to the negative market developments through their lenders' position. Thus, the interaction term between the *Lenders' Indicator* and the Crisis dummy can be compared to a treatment intensity variable. Consequently, even though the empirical approach adopted in this Section is not a "pure" differences-in-differences model, it retains the main features of that models.

Broadly, the main findings discussed in the previous sections continue to be valid under this empirical approach, such as the importance of lenders' funding positions.

Table 3.9: Alternative approach: Firms' employment

	Funding structure					Sovereign exposure		Solvency		Funding	Collateral
	1	2	3	4	5	6	7	8	9	10	11
LI_{09}:	Central bank	Interbank	Market	Dep_A	LTD	PT Sovereign	Sovereign	Tier 1 Capital	Total capital	Liq. Gap	Elegible A
LI_{09}*CRISIS	0.0244	-0.0227***	-0.0157**	0.0140**	0.0002	0.1428***	0.1448***	-0.0176	-0.0255	0.0001	0.0539***
	(0.42)	(-2.72)	(-2.18)	(2.07)	(0.63)	(2.84)	(2.78)	(-0.97)	(-1.52)	(0.87)	(2.71)
PROFITABILITYt-1	0.0321***	0.0323***	0.0322***	0.0321***	0.0321***	0.0316***	0.0317***	0.0322***	0.0323***	0.0320***	0.0316***
	(3.87)	(3.89)	(3.88)	(3.87)	(3.87)	(3.81)	(3.81)	(3.88)	(3.89)	(3.86)	(3.80)
SALES GROWTHt-1	0.0492***	0.0493***	0.0493***	0.0493***	0.0493***	0.0493***	0.0493***	0.0493***	0.0493***	0.0493***	0.0492***
	(16.00)	(16.00)	(16.01)	(16.01)	(16.00)	(16.01)	(16.01)	(16.00)	(16.00)	(16.00)	(15.98)
SIZEt-1	-0.0625***	-0.0625***	-0.0626***	-0.0624***	-0.0625***	-0.0624***	-0.0623***	-0.0626***	-0.0626***	-0.0626***	-0.0624***
	(-22.85)	(-22.87)	(-22.90)	(-22.83)	(-22.88)	(-22.84)	(-22.79)	(-22.88)	(-22.89)	(-22.88)	(-22.81)
BANK DEBTt-1	-0.0444***	-0.0443***	-0.0443***	-0.0432***	-0.0443***	-0.0444***	-0.0441***	-0.0444***	-0.0444***	-0.0444***	-0.0446***
	(-8.27)	(-8.27)	(-8.27)	(-8.02)	(-8.26)	(-8.27)	(-8.23)	(-8.28)	(-8.29)	(-8.27)	(-8.31)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Crisis dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm-fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	86,304	86,304	86,304	86,304	86,304	86,304	86,304	86,304	86,304	86,304	86,304
R^2	0.0967	0.0969	0.0969	0.0968	0.0968	0.0969	0.0969	0.0968	0.0968	0.0968	0.0969

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The econometric models include firm-fixed effects and robust standard errors. All regressions include a constant term. Each column corresponds to an alternative criterion to classify firms' lenders as more vulnerable to sovereign debt crisis and its consequences (*i.e.* weaker institutions). The dependent variable is EMPLOYMENT, defined as change in the average number of employees for each firm in a year over the average number of employees at the end of the previous year. Looking at the independent variables, PROFITABILITY is defined as net earnings before provisions and depreciation over total assets; SALES GROWTH is defined as year-on-year change rate of sales; SIZE is based on the natural logarithm of real total assets; BANK DEBT defined as debt over total assets. $LI_{i,09}$ is the interaction term between the firm-lenders indicator under analysis in each column and the weight of each lender in firm's debt at end-2009. $LI_{i,09} \times Crisis$ corresponds to the interaction between the previous variable and the dummy variable that identifies the period after 2010.

Additionally, the results highlight the relevance of collateral to overcome tensions in the financial markets, through the ECB monetary operations.

3.8 Robustness

In this study, we analyzed firms' outcomes exploring the heterogeneity on firm's lenders' exposure to the adverse developments in financial markets, in the context of the sovereign debt crisis. The variable of interest was *Lenders' Indicator*, measured by several alternative criteria. Following the specification presented in Section 3.7.1, we run some additional regressions, in order to assess how the results change due to some adopted hypotheses.

First, we replace the firm-fixed effects component (z_i), in equation 3.3, with interaction terms between firms' business sector and the time dimension. These variables allow us to control, in some way, changes in firms' activity sector over time, which may influence firms' credit demand and decisions. In particular, we run the following specification:

$$y_{i,t} = c + \alpha X_{i,t-1} + \phi Crisis + \beta LI_{i,09} \times Crisis + \delta S_i \times Crisis + \mu_{i,t} + \mu_{i,t} \qquad (3.4)$$

where $S_i \times Crisis$ corresponds to the interaction term between firm i's business sector, S_i, and the time dummy *Crisis*. The remaining variables, both on right-hand and left-hand sides in the equation, are defined as described in Section 3.7.1, namely: $y_{i,t}$ corresponds to the average investment or average employment of firm i in the period t (2008/2009 and 2011/2012); $X_{i,t-1}$ is a vector of firm-specific variables evaluated at $t-1$; $LI_{i,09}$ is the *Lenders' Indicator* based on all firm's lenders i at the end of 2009; while $\mu_{i,t}$ corresponds to the error term. The results obtained under this set up are in line with those discussed above.

The next test comprises the inclusion of other lenders characteristics as explanatory variables in equation 3.3. Hence, in addition to the *Lenders' Indicator*, which remains the key variable in the analysis, we include measures related to leverage, profitability, and size of firms' lenders.[26]

In this robustness exercise, we run the following specification:

$$y_{i,t} = c + \alpha X_{i,t-1} + \delta z_i + \phi Crisis + \beta LI_{i,09} \times Crisis + \varphi LC_{i,09} + \mu_{i,t} \tag{3.5}$$

where $LC_{i,09}$ is the vector of additional variables for lenders of firm i, assessed at the end of 2009 (lenders' control variables). The remaining variables included in the specification preserve the same definition as described in Section 3.7.1.

According to results obtained, the general conclusions continue broadly to hold under this conjecture. Nevertheless, there are some adjustments in the estimated coefficients related to *Lenders' Indicator*, but they are not sizable. The results obtained under this framework are shown in Tables III.7 and III.8, in the Appendices Section of this Chapter, for firms' investment and employment outcomes, respectively.

Therefore, even replacing firm-fixed effects by other firms' controls, or including some lenders' control variables, the empirical evidence continues to identify some impact on firms' decisions related to lenders' dependence on interbank and financial markets, as well as the availability of assets eligible as collateral in ECB operations. Looking at employment changes, in addition to these lenders' features, lenders' sovereign debt securities portfolios have also impact on firms' outcomes.

[26]The procedure adopted to compute lenders control variables at firm level followed the approach of *Lenders' Indicator*, *i.e.* a weighted average of firm's lenders' characteristics. The definitions of the control variables are presented in Table III.3 in the Appendices Section.

3.9 Final Remarks

Recent years have seen unprecedented events. First, the financial crisis related to the US sub-prime mortgage market, the collapse of Lehman Brothers, and the severe worldwide economic recession in 2009. Afterwards, the euro area faced several challenges due to the onset of the sovereign debt crisis in mid-2010. Those events dramatically affected the international financial markets and had consequences for financial systems. Indeed, following those events, financial intermediaries were forced to revise their funding and business strategies, taking into account a new and more demanding regulatory framework. Simultaneously, financial systems in some countries recorded additional constraints imposed by the international rescue programs. Against this background, the discussion on the transmission of the financial position of intermediary institutions to the real economy, in particular the corporate sector, became a topical issue in the economic and financial literature for academics and policy-makers.

Portugal was one of the countries especially affected by the sovereign debt crisis, which led to the International Financial Assistance Programme in April 2011. The sovereign-bank link also had significant negative spillovers to the Portuguese banking institutions, which play a crucial role as financial intermediary for the Portuguese economy.

This study investigates the potential differences in firms' investment and employment decisions, taking into account all firm-bank relationships and the vulnerability of firms' lenders to the adverse financial market developments, in the context of the sovereign debt crisis. We compute the *Lenders' Indicator*, which is a weighted indicator for each firm based on lenders' characteristics and the share of each lender in the firm's total bank debt. Higher and lower *Lenders' Indicators* represent different vulnerabilities to the negative shock. In other words, we compare the path of

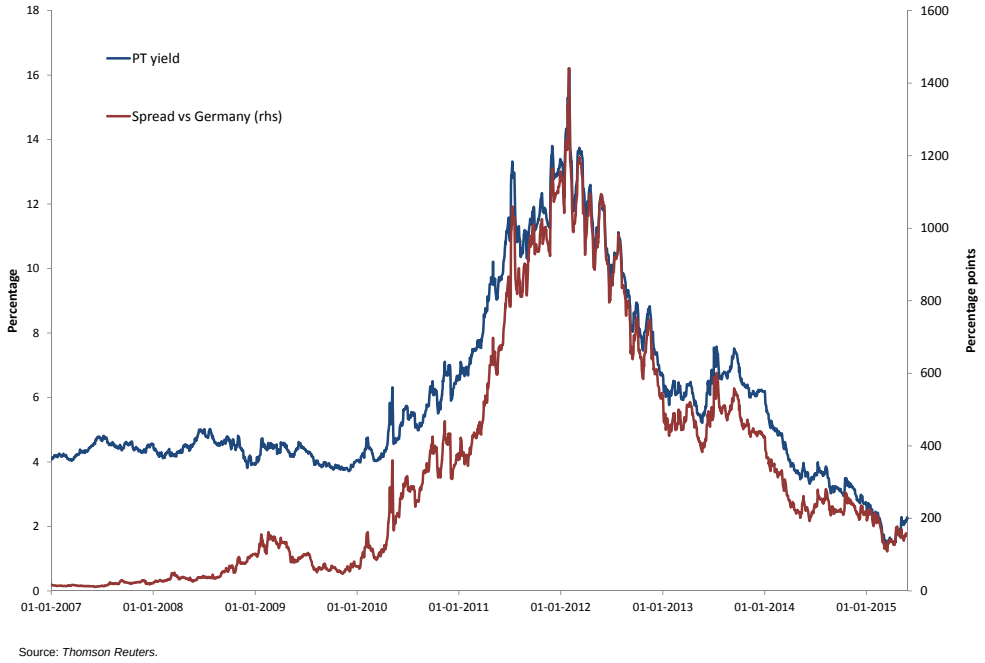
investment and employment for the period 2007-2012, exploring firm's lenders' heterogeneity. The results obtained highlight the relevance lenders' funding structure. In particular, firms whose lenders depend more on market funding present a poorer investment and employment path. This suggests that there was some transmission of lenders' vulnerabilities to the corporate sector. This result is reinforced when we assess lenders' positions at the end of 2009, before the unexpected negative shock on sovereign debt markets. The results also show the relevance of eligible assets to pledge as collateral in monetary operations, measured at end-2009, in overcoming negative shocks. We found a positive impact of this indicator on average investment and employment decisions after 2010. However, based on other lenders' characteristics, namely the sovereign debt securities portfolios or even solvency position, the results are not so conclusive. While the results suggest that there was no impact on firms' investment decisions, there is some evidence of the impact of lenders' sovereign securities exposures on employment outcomes.

The different results observed in the investment and employment analysis may be related to the fact that investment reacts more quickly to the economic activity, uncertainty, or agents' confidence. Investment was already affected by the financial crisis and the economic recession in 2009. In turn, employment tends to present a higher lag of adjustment to adverse environments.

The empirical findings of this study suggest that the linkage of banking institutions and sovereigns could play an important role for corporate activity, and consequently for economic developments. The results also illustrate the need to improve the general economic analytical tools, taking into account the link between economic agents, financial system, and sovereigns. This is especially important for a small and open economy, mainly when it is highly dependent on international savings flows, such as the Portuguese case, which may amplify its exposure to international shocks.

Appendices

Figure III.1: PT sovereign bonds (10 years)



Source: *Thomson Reuters.*

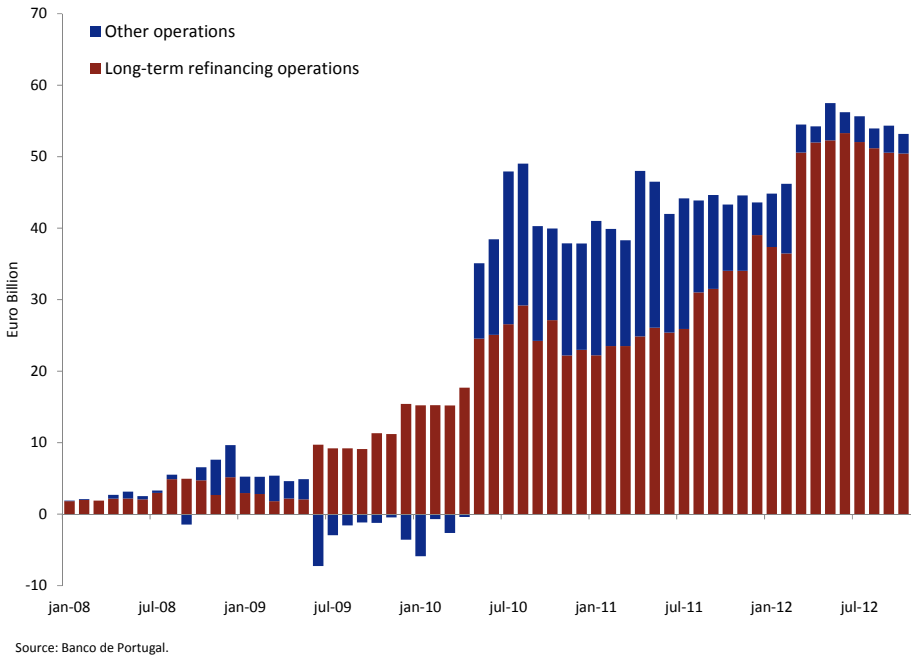
This figure presents the Portuguese 10 year bond yields and the respective spread against comparable German bonds.

Figure III.2: Credit default swap spreads of Portuguese banks (5 years senior)

Sources: *Bloomberg* and *Thomson Reuters*.

This figure shows the CDS spreads of some major Portuguese banks, and the comparison with the CDS spread of iTraxx, that includes other banking institutions.

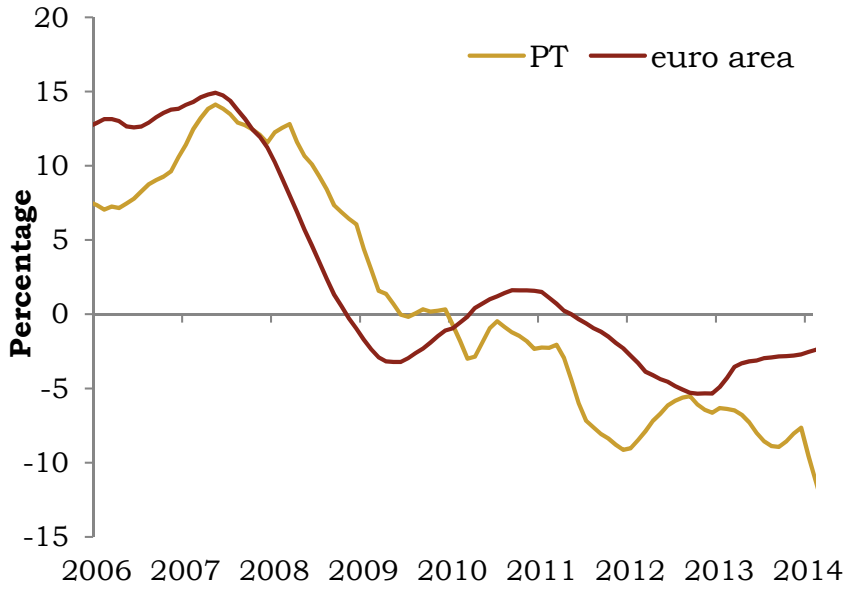
Figure III.3: Outstanding amounts of monetary policy operations of resident banks



Source: Banco de Portugal.

This figure shows the credit obtained by resident banks in ECB monetary operations since 2008 and the first years of the sovereign debt crisis in the euro zone.

Figure III.4: Credit growth rate (year-on-year)



Source: Banco de Portugal.
This figure shows annual growth rate of bank loans granted to non-financial private sector from 2006 to 2014.

Table III.1: Variables definition - Firms

Variables	**Definition**
Dependent variables	
INVESTMENT GROWTH	Flow of investment in tangible and intangible assets for each firm in a year over the total of those assets at the end of the previous year
EMPLOYMENT GROWTH	Change in the average number of employees of each firm in a year over the average number in the previous year
Firm's characteristics	
PROFITABILITY	Net earnings before provisions and depreciation over total assets
BANK CREDIT	Bank debt over total assets
SALES GROWTH	Year-on-year change rate of sales
SIZE	Natural logarithm of real total assets
NUMBER RELATIONSHIPS	Number of banking relationships defined at the banking group level, based on the weight of each group in firm's total bank debt
Lenders' Indicator	
LI - LENDERS' INDICATOR	Interaction term between all firm-lenders' characteristics (based on indicators present below) and the respective weight in firm's total bank debt.

Table III.2: Sample summary statistics - Firm characteristics

	Nr.	Mean	Sd	p10	p25	p50	p75	p90
SIZE	211,741	13.78	1.45	12.11	12.82	13.63	14.58	15.63
PROFITABILITY	211,752	0.09	0.12	-0.01	0.04	0.09	0.14	0.22
SALES GROWTH	211,747	-0.03	0.26	-0.32	-0.14	-0.02	0.09	0.24
BANK CREDIT	211,752	0.66	0.31	0.30	0.47	0.66	0.81	0.93
ASSETS GROWTH	211,752	0.04	0.23	-0.18	-0.08	0.01	0.12	0.30
WORKING CAPITAL	211,752	0.16	0.35	-0.26	-0.02	0.18	0.39	0.57
ACCOUNTS PAYABLE	211,752	0.19	0.16	0.02	0.06	0.16	0.28	0.42
ACCOUNTS RECEIVABLE	211,752	0.28	0.22	0.00	0.08	0.25	0.43	0.59
TANGIBILITY	211,752	0.28	0.23	0.03	0.09	0.23	0.42	0.64
INVENTORIES	211,752	0.18	0.21	0.00	0.01	0.10	0.27	0.49
ASSET TURNOVER	211,752	1.33	1.01	0.41	0.70	1.09	1.65	2.47
CASHFLOW	211,752	0.06	0.26	-0.20	-0.03	0.07	0.18	0.33
CASH AND EQUIVALENTS	211,752	0.29	0.62	0.01	0.02	0.08	0.26	0.72
AGE	211,752	19.72	13.31	7.00	10.00	17.00	25.00	35.00
NUMBER RELATIONSHIPS	211,752	3.24	2.24	1.00	2.00	3.00	4.00	6.00

Note: sd stands for standard deviation, while p10, p25, p50, p75, and p90 stand for the percentiles 10, 25, 50, 75, and 90, respectively, of the distribution of each variable, for observations included in the econometric analysis. Looking at the variables presented, SIZE is the natural logarithm of real total assets; PROFITABILITY is defined as net earnings before provisions and depreciation over total assets; BANK CREDIT is defined as bank debt over total assets; SALES GROWTH is defined as Year-on-year change rate of sales; ASSETS GROWTH corresponds to the growth rate of total assets; WORKING CAPITAL is defined as current assets net of short term liabilities over total assets; ACCOUNTS PAYABLE is defined as accounts payable over total assets; ACCOUNTS RECEIVABLE is defined as accounts receivable over total assets; TANGIBILITY corresponds to tangible assets over total assets; INVENTORIES is defined as inventories over total assets; ASSET TURNOVER is defined as sales over total assets; CASHFLOW corresponds to the ratio of cashflow over total assets; CASH AND EQUIVALENTS is defined as cash and equivalents over total assets; AGE is defined in years. NUMBER RELATIONSHIPS reflects the number of banking relationships defined at the banking group level, based on the weight of each group in firm's total bank debt.

Table III.3: Variables definition - Lenders

Variable	Definition
Lenders' Indicator	
Funding structure	
CENTRAL BANK	Central bank funding over total assets
INTERBANK	Interbank market over total assets
MARKET FUNDING	Wholesale and interbank markets over total assets
DEPOSITS_A	Customers' deposits over total assets
LOAN-TO-DEPOSIT	Loans over customers' deposits
LIQUIDITY GAP	Gap between assets and liabilities mismatch for 6-12 months
Debt Securities Portfolio	
PT SOVEREIGN	Portuguese sovereign debt securities over total assets
SOVEREIGN	Total sovereign debt securities over total assets
Collateral	
ELIGIBLE ASSETS	Assets eligible as collateral in monetary operations with central banks
Solvency	
TIER 1 RATIO	Tier 1 capital over risk weighted assets
CAPITAL RATIO	Total regular capital over risk weighted assets
Control variables	
LEVERAGE	Capital over total assets
PROFITABILITY	Returns on total assets
SIZE	Natural logarithm of total assets

Table III.4: Correlation Matrix: Investment, employment, and lenders' characteristics

	INVEST.	EMPL.	CENTRAL B.	INTER B.	MARKET	LIQ. GAP	PT SOV.	SOV.	EL. ASSETS	R_TIER1	R_CAPITAL	DEP_A	LOAN-TO-DEP
INVESTMENT	1.000												
EMPLOYMENT	0.145	1.000											
CENTRAL BANK	-0.053	-0.112	1.000										
INTER BANK	-0.015	-0.026	0.012	1.000									
MARKET	-0.026	-0.050	0.184	0.764	1.000								
LIQ. GAP	0.008	0.051	-0.264	-0.269	-0.338	1.000							
PT SOVEREIGN	-0.045	-0.100	0.608	-0.016	-0.024	-0.040	1.000						
SOVEREIGN	-0.049	-0.105	0.608	-0.016	0.059	-0.067	0.962	1.000					
EL. ASSETS	-0.037	-0.115	0.733	-0.001	0.073	-0.307	0.788	0.746	1.000				
R_TIER1	-0.031	-0.055	0.299	0.032	0.187	0.242	0.404	0.470	0.379	1.000			
R_CAPITAL	-0.028	-0.046	0.255	0.052	0.284	0.230	0.320	0.414	0.285	0.972	1.000		
DEPOSITS_A	-0.059	-0.099	0.331	0.062	0.307	0.011	0.488	0.608	0.337	0.489	0.559	1.000	
LOAN-TO-DEP	-0.008	-0.006	0.007	0.263	0.197	-0.019	-0.007	-0.007	-0.003	0.078	0.079	-0.011	1.000

Note: INVESTMENT is defined as the flow of investment in tangible and intangible assets for each firm in a year over the total of those assets at the end of the previous year. EMPLOYMENT is defined as change in the average number of employees for each firm in a year over the average number of employees at the end of the previous year. The remaining variables characterize several dimensions on firm's lenders, namely: CENTRAL BANK is defined as the central bank funding over total assets; INTERBANK is defined as interbank funding over total assets; MARKET is defined as Wholesale and interbank markets over total assets; LIQ. GAP is defined as the gap between assets and liabilities mismatch for 6-12 months; SOV. PT is defined as the Portuguese sovereign debt securities over total assets; SOVEREIGN is defined as the total sovereign debt securities over total assets; EMPLOYMENT EL. ASSETS is defined as Assets eligible as collateral in monetary operations with central banks; R_TIER1 corresponds to the Tier 1 capital over risk weighted assets; R_CAPITAL corresponds to the Total regular capital over risk weighted assets; DEPOSITS_A is defined as customers' deposits over total assets; LOAN-TO-DEP is defined as loans over customers' deposits.

Table III.5: Firms' investment decisions - yearly approach

	Funding structure						Sovereign exposure		Solvency
	1	2	3	4	5	6	7	8	9
LI:	Central bank	Interbank	Market	Dep_A	LTD	Sovereign	PT Sovereign	Tier 1 Capital	Total capital
LI_{t-1}	-0.0641	-0.0204	-0.0340	0.0170	-0.0004	0.2234	-0.1334	-0.0406	-0.0512
	(-0.22)	(-0.48)	(-0.98)	(0.49)	(-0.50)	(0.54)	(-0.37)	(-0.21)	(-0.24)
LI_{t-1}*2009	0.3183	-0.0837*	-0.0562	0.0455	-0.0011	0.7531	0.1470	-0.0739	-0.0503
	(0.97)	(-1.75)	(-1.32)	(1.15)	(-1.22)	(1.28)	(0.35)	(-0.36)	(-0.23)
LI_{t-1}*2010	-0.4261	-0.0754	-0.0651	-0.0442	-0.0019	-0.4481	-0.2260	-0.1028	-0.1187
	(-1.04)	(-1.35)	(-1.40)	(-1.03)	(-1.23)	(-1.00)	(-0.56)	(-0.48)	(-0.52)
LI_{t-1}*2011	0.1132	-0.1228**	-0.1137***	-0.0642	-0.0007	-0.2676	0.0237	-0.1046	-0.1032
	(0.37)	(-2.54)	(-2.60)	(-1.55)	(-0.77)	(-0.67)	(0.07)	(-0.53)	(-0.48)
LI_{t-1}*2012	0.1889	-0.1172**	-0.1108***	0.0029	-0.0010	0.0092	0.2918	0.0002	-0.0114
	(0.62)	(-2.55)	(-2.64)	(0.07)	(-1.20)	(0.02)	(0.81)	(0.00)	(-0.05)
PROFITABILITYt-1	0.0795***	0.0807***	0.0802***	0.0792***	0.0801***	0.0795***	0.0793***	0.0794***	0.0794***
	(3.22)	(3.27)	(3.25)	(3.21)	(3.25)	(3.22)	(3.21)	(3.22)	(3.22)
SALES GROWTHt-1	0.1050***	0.1046***	0.1047***	0.1048***	0.1048***	0.1049***	0.1049***	0.1050***	0.1050***
	(14.54)	(14.48)	(14.49)	(14.51)	(14.51)	(14.51)	(14.52)	(14.54)	(14.54)
SIZEt-1	-0.5164***	-0.5152***	-0.5160***	-0.5164***	-0.5162***	-0.5163***	-0.5164***	-0.5165***	-0.5165***
	(-49.68)	(-49.57)	(-49.67)	(-49.62)	(-49.69)	(-49.68)	(-49.67)	(-49.72)	(-49.73)
BANK DEBTt-1	-0.3943***	-0.3926***	-0.3939***	-0.3962***	-0.3944***	-0.3943***	-0.3941***	-0.3946***	-0.3948***
	(-22.77)	(-22.69)	(-22.76)	(-22.78)	(-22.80)	(-22.72)	(-22.70)	(-22.79)	(-22.81)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm-fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	211,752	211,752	211,752	211,752	211,752	211,752	211,752	211,752	211,752
R^2	0.0520	0.0522	0.0521	0.0520	0.0522	0.0520	0.0520	0.0520	0.0520

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The econometric models include firm-fixed effects and robust standard errors. All regressions include a constant term. Each column corresponds to an alternative criterion to classify firms' lenders as more vulnerable to sovereign debt crisis and its consequences (*i.e.* more vulnerable institutions). The dependent variable is INVESTMENT, defined as the flow of investment in tangible and intangible assets for each firm in a year over the total of those assets at the end of the previous year. Looking at the independent variables, PROFITABILITY is defined as net earnings before provisions and depreciation over total assets; SALES GROWTH is defined as year-on-year change rate of sales; SIZE is based on the natural logarithm of real total assets; BANK DEBT defined as debt over total assets. $LI_{i,t-1}$ is the interaction term between the firm-lenders indicator under analysis in each column and the respective weight of each lender. $LI\times$ year corresponds to the interaction between the previous variable and the year dummies (2008 to 2012).

Table III.6: Firms' employment decisions - yearly approach

	Funding structure					Sovereign exposure		Solvency	
	1	2	3	4	5	6	7	8	9
LI:	Central bank	Interbank	Market	Dep_A	LTD	Sovereign	PT Sovereign	Tier 1 Capital	Total capital
LI_{t-1}	-0.1384*	0.0274***	0.0136	-0.0209**	0.0005**	-0.1535	-0.1540	-0.0724	-0.0821
	(-1.91)	(2.61)	(1.52)	(-2.33)	(2.26)	(-1.28)	(-1.56)	(-1.34)	(-1.40)
LI_{t-1}*2009	0.1273	-0.0397***	-0.0243**	0.0163	-0.0005	0.0673	0.0906	0.1176**	0.1255**
	(1.52)	(-3.13)	(-2.12)	(1.49)	(-1.51)	(0.40)	(0.77)	(2.03)	(2.06)
LI_{t-1}*2010	0.1045	-0.0322**	-0.0346***	0.0147	-0.0001	0.1359	0.1057	0.0596	0.0638
	(1.01)	(-2.38)	(-2.99)	(1.32)	(-0.22)	(1.07)	(0.97)	(1.03)	(1.05)
LI_{t-1}*2011	0.0909	-0.0328***	-0.0315***	0.0243**	-0.0004*	0.1882	0.1679*	0.0508	0.0536
	(1.20)	(-2.66)	(-2.80)	(2.23)	(-1.73)	(1.64)	(1.75)	(0.92)	(0.91)
LI_{t-1}*2012	0.1842**	-0.0514***	-0.0436***	0.0418***	-0.0003	0.2913**	0.2972***	0.1199**	0.1216**
	(2.46)	(-4.23)	(-3.82)	(3.80)	(-1.47)	(2.49)	(3.01)	(2.18)	(2.06)
PROFITABILITYt-1	0.0809***	0.0810***	0.0811***	0.0810***	0.0808***	0.0810***	0.0810***	0.0810***	0.0810***
	(12.94)	(12.94)	(12.96)	(12.95)	(12.92)	(12.95)	(12.96)	(12.95)	(12.95)
SALES GROWTHt-1	0.0367***	0.0367***	0.0367***	0.0367***	0.0368***	0.0367***	0.0367***	0.0367***	0.0367***
	(17.35)	(17.32)	(17.33)	(17.35)	(17.37)	(17.34)	(17.33)	(17.35)	(17.35)
SIZEt-1	-0.0418***	-0.0416***	-0.0417***	-0.0417***	-0.0418***	-0.0417***	-0.0416***	-0.0417***	-0.0418***
	(-19.51)	(-19.39)	(-19.46)	(-19.41)	(-19.49)	(-19.43)	(-19.41)	(-19.48)	(-19.48)
BANK DEBTt-1	-0.0393***	-0.0385***	-0.0387***	-0.0379***	-0.0387***	-0.0380***	-0.0381***	-0.0389***	-0.0389***
	(-8.96)	(-8.80)	(-8.83)	(-8.63)	(-8.84)	(-8.67)	(-8.69)	(-8.89)	(-8.89)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm-fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	212,288	212,288	212,288	212,288	212,288	212,288	212,288	212,288	212,288
R^2	0.0397	0.0398	0.0397	0.0397	0.0397	0.0397	0.0397	0.0398	0.0398

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The econometric models include firm-fixed effects and robust standard errors. All regressions include a constant term. Each column corresponds to an alternative criterion to classify firms' lenders as more vulnerable to sovereign debt crisis and its consequences (*i.e.* more vulnerable institutions). The dependent variable is EMPLOYMENT, defined as change in the average number of employees for each firm in a year over the average number of employees at the end of the previous year. Looking at the independent variables, PROFITABILITY is defined as net earnings before provisions and depreciation over total assets; SALES GROWTH is defined as year-on-year change rate of sales; SIZE is based on the natural logarithm of real total assets; BANK DEBT defined as debt over total assets. $LI_{i,t-1}$ is the interaction term between the firm-lenders indicator under analysis in each column and the respective weight of each lender. $LI\times$ year corresponds to the interaction between the previous variable and the year dummies (2008 to 2012).

Table III.7: Alternative approach: Firms' investment

	Funding structure					Sovereign exposure		Solvency		Funding	Collateral
	1	2	3	4	5	6	7	8	9	10	11
LI_{09}:	Central bank	Interbank	Market	Dep_A	LTD	PT Sovereign	Sovereign	Tier 1 Capital	Total capital	Liq. Gap	Elegible A
LI_{09}*CRISIS	0.2364	-0.0662*	-0.0621**	-0.0096	-0.0016	0.1549	0.3000	-0.0732	-0.0993	-0.0001	0.1485*
	(0.92)	(-1.87)	(-2.09)	(-0.36)	(-0.75)	(0.74)	(1.36)	(-0.64)	(-0.96)	(-0.31)	(1.68)
PROFITABILITYt-1	-0.0123	-0.0117	-0.0120	-0.0123	-0.0122	-0.0128	-0.0130	-0.0120	-0.0119	-0.0122	-0.0135
	(-0.36)	(-0.35)	(-0.36)	(-0.36)	(-0.36)	(-0.38)	(-0.39)	(-0.36)	(-0.35)	(-0.36)	(-0.40)
SALES GROWTHt-1	0.0917***	0.0918***	0.0919***	0.0917***	0.0917***	0.0917***	0.0918***	0.0917***	0.0917***	0.0917***	0.0916***
	(8.07)	(8.08)	(8.09)	(8.07)	(8.07)	(8.08)	(8.08)	(8.07)	(8.07)	(8.07)	(8.06)
SIZEt-1	-0.4299***	-0.4301***	-0.4305***	-0.4302***	-0.4301***	-0.4301***	-0.4298***	-0.4303***	-0.4303***	-0.4301***	-0.4298***
	(-37.41)	(-37.45)	(-37.48)	(-37.42)	(-37.45)	(-37.44)	(-37.40)	(-37.43)	(-37.44)	(-37.45)	(-37.40)
BANK DEBTt-1	-0.4282***	-0.4277***	-0.4275***	-0.4285***	-0.4281***	-0.4277***	-0.4271***	-0.4282***	-0.4285***	-0.4278***	-0.4281***
	(-20.32)	(-20.32)	(-20.31)	(-20.17)	(-20.33)	(-20.32)	(-20.29)	(-20.33)	(-20.35)	(-20.32)	(-20.34)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Crisis dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Lenders controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm-fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	86102	86102	86102	86102	86102	86102	86102	86102	86102	86102	86102
R^2	0.0915	0.0915	0.0916	0.0914	0.0915	0.0915	0.0915	0.0915	0.0915	0.0914	0.0915

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The econometric models include firm-fixed effects and robust standard errors. All regressions include a constant term. Each column corresponds to an alternative criterion to classify firms' lenders as more vulnerable to sovereign debt crisis and its consequences (*i.e.* weaker institutions). The dependent variable is EMPLOYMENT, defined as change in the average number of employees for each firm in a year over the average number of employees at the end of the previous year. Looking at the independent variables, PROFITABILITY is defined as net earnings before provisions and depreciation over total assets; SALES GROWTH is defined as year-on-year change rate of sales; SIZE is based on the natural logarithm of real total assets; BANK DEBT defined as debt over total assets. $LI_{i,09}$ is the interaction term between the firm-lenders indicator under analysis in each column and the weight of each lender in firm's debt at end-2009. $LI_{i,09} \times Crisis$ corresponds to the interaction between the previous variable and the dummy variable that identifies the period after 2010.

Table III.8: Alternative approach: Firms' employment

	Funding structure					Sovereign exposure		Solvency		Funding	Collateral
	1	2	3	4	5	6	7	8	9	10	11
LI_{09}:	Central bank	Interbank	Market	Dep_A	LTD	PT Sovereign	Sovereign	Tier 1 Capital	Total capital	Liq. Gap	Elegible A
LI_{09}*CRISIS	0.0174	-0.0254***	-0.0202***	0.0150**	0.0002	0.1573***	0.1726***	0.0408	0.0128	0.0002**	0.0699***
	(0.29)	(-2.95)	(-2.73)	(2.22)	(0.53)	(3.04)	(3.14)	(1.42)	(0.50)	(2.47)	(3.29)
PROFITABILITYt-1	0.0322***	0.0324***	0.0323***	0.0322***	0.0322***	0.0317***	0.0317***	0.0320***	0.0321***	0.0320***	0.0316***
	(3.88)	(3.90)	(3.89)	(3.87)	(3.88)	(3.82)	(3.82)	(3.85)	(3.87)	(3.85)	(3.81)
SALES GROWTHt-1	0.0493***	0.0493***	0.0494***	0.0493***	0.0493***	0.0493***	0.0493***	0.0493***	0.0493***	0.0493***	0.0492***
	(16.01)	(16.01)	(16.03)	(16.02)	(16.01)	(16.02)	(16.02)	(16.01)	(16.01)	(16.01)	(15.99)
SIZEt-1	-0.0625***	-0.0625***	-0.0626***	-0.0624***	-0.0625***	-0.0624***	-0.0623***	-0.0624***	-0.0625***	-0.0626***	-0.0623***
	(-22.85)	(-22.87)	(-22.90)	(-22.82)	(-22.87)	(-22.84)	(-22.78)	(-22.83)	(-22.85)	(-22.90)	(-22.81)
BANK DEBTt-1	-0.0442***	-0.0442***	-0.0441***	-0.0430***	-0.0441***	-0.0441***	-0.0438***	-0.0439***	-0.0441***	-0.0441***	-0.0443***
	(-8.24)	(-8.23)	(-8.23)	(-7.97)	(-8.23)	(-8.23)	(-8.17)	(-8.18)	(-8.21)	(-8.23)	(-8.27)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Crisis dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Lenders controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm-fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Nr.	86304	86304	86304	86304	86304	86304	86304	86304	86304	86304	86304
R^2	0.0969	0.0971	0.0971	0.0970	0.0969	0.0971	0.0971	0.0969	0.0969	0.0970	0.0971

Note: ***, **, and * denote statistical significance levels at 1, 5, and 10 per cent, respectively. The t-statistics are in parentheses. The econometric models include firm-fixed effects and robust standard errors. All regressions include a constant term. Each column corresponds to an alternative criterion to classify firms' lenders as more vulnerable to sovereign debt crisis and its consequences (*i.e.* weaker institutions). The dependent variable is EMPLOYMENT, defined as change in the average number of employees for each firm in a year over the average number of employees at the end of the previous year. Looking at the independent variables, PROFITABILITY is defined as net earnings before provisions and depreciation over total assets; SALES GROWTH is defined as year-on-year change rate of sales; SIZE is based on the natural logarithm of real total assets; BANK DEBT defined as debt over total assets. $LI_{i,09}$ is the interaction term between the firm-lenders indicator under analysis in each column and the weight of each lender in firm's debt at end-2009. $LI_{i,09} \times Crisis$ corresponds to the interaction between the previous variable and the dummy variable that identifies the period after 2010.

Bibliography

Acemoglu, D. & Lyle, D. (2004), 'Women, war, and wages: The effect of female labor supply on the wage structure at midcentury', *Journal of political Economy* **112**(3), 497–551.

Acharya, V., Davydenko, S. A. & Strebulaev, I. A. (2012), 'Cash Holdings and Credit Risk', *Review of Financial Studies* **25**(12), 3572–3609.

Acharya, V. V., Eisert, T., Eufinger, C. & Hirsch, C. W. (2016), 'Real effects of the sovereign debt crisis in Europe: Evidence from syndicated loans', *Available at SSRN 2612855* .

Adelino, M. & Ferreira, M. A. (2016), 'Bank ratings and lending supply: Evidence from sovereign downgrades', *Review of Financial Studies* **29**(7), 1709–1746.

Adrian, T., Colla, P. & Shin, H. S. (2012), Which Financial Frictions? Parsing the Evidence from the Financial Crisis of 2007-9, NBER Working Papers 18335, National Bureau of Economic Research, Inc.

Agarwal, V. & Taffler, R. (2008), 'Comparing the performance of market-based and accounting-based bankruptcy prediction models', *Journal of Banking & Finance* **32**(8), 1541–1551.

Almeida, H., Cunha, I., Ferreira, M. A. & Restrepo, F. (2016), 'The Real Effects of Credit Ratings: The Sovereign Ceiling Channel', *Journal of Finance* (forthcoming).

Almeida, V. & Félix, R. (2006), Computing potential output and the output gap for the Portuguese economy, Economic Bulletin Autumn, Banco de Portugal.

Altman, E. I. (1968), 'Financial ratios, discriminant analysis and the prediction of corporate bankruptcy', *Journal of Finance* **23**(4), 589–609.

Amador, J. & Coimbra, C. (2007), Characteristics of the Portuguese economic growth: what has been missing?, Working Paper w200708, Banco de Portugal.

Angrist, Joshua D and Pischke, Jörn-Steffen (2008), Parallel worlds: fixed effects, differences-in-differences, and panel data, *in* 'Mostly harmless econometrics: An empiricist's companion', Princeton university press, chapter 5.

Antão, P. & Bonfim, D. (2012), The dynamics of capital structure decisions, Working Papers w201206, Banco de Portugal, Economics and Research Department.

Antunes, A. & Martinho, R. (2012), 'A Scoring model to Portuguese firms', *Financial Stability Report* .

Antunes, A., Ribeiro, N. & Antão, P. (2005), 'Estimating probabilities of default under macroeconomic scenarios', *Financial Stability Report— 2005* p. 115.

Atanasova, C. V. & Wilson, N. (2004), 'Disequilibrium in the UK corporate loan market', *Journal of Banking & Finance* **28**(3), 595–614.

Bae, K.-H., Kang, J.-K. & Lim, C.-W. (2002), 'The value of durable bank relationships: evidence from Korean banking shocks', *Journal of Financial Economics* **64**(2), 181–214.

Banco de Portugal (2008), 'Simplified reporting: Inclusion of the Simplified Corporate Information in the Statistics on Non-Financial Corporations from the Central Balance-Sheet Database', *Supplements to the Statistical Bulletin* **1**.

Banco de Portugal (2011*a*), Central de Responsabilidades de Crédito', Cadernos Nr.5, Banco de Portugal.

Banco de Portugal (2011*b*), Financial Stability Review, Technical report.

Barclay, M. J. & Smith, Clifford W, J. (1995), 'The Priority Structure of Corporate Liabilities', *Journal of Finance* **50**(3), 899–917.

Beaver, W. H. (1966), 'Financial ratios as predictors of failure', *Journal of Accounting Research* **4**, 71–111.

Becker, B. & Ivashina, V. (2014), 'Cyclicality of credit supply: Firm level evidence', *Journal of Monetary Economics* **62**, 76–93.

Benito, A., Delgado, F. J. & Pagés, J. M. (2004), A synthetic indicator of financial pressure for Spanish firms, Working Papers 0411, Banco de España.

Bentolila, S., Jansen, M., Jiménez, G. & Ruano, S. (2015), When Credit Dries Up: Job Losses in the Great Recession, Technical report.

Benzoni, L., Collin-Dufresne, P., Goldstein, R. S. & Helwege, J. (2015), 'Modeling credit contagion via the updating of fragile beliefs', *Review of Financial Studies* **28**(7), 1960–2008.

Berger, A. N. & Udell, G. F. (1995), 'Relationship Lending and Lines of Credit in Small Firm Finance', *Journal of Business* **68**(3), 351–81.

Berger, A. N. & Udell, G. F. (2006), 'A more complete conceptual framework for SME finance', *Journal of Banking & Finance* **30**(11), 2945–2966.

Bernanke, B. & Gertler, M. (1989), 'Agency Costs, Net Worth, and Business Fluctuation', *American Economic Review* **1989**, 14–31.

Bernanke, B. S. (1983), 'Nonmonetary Effects of the Financial Crisis in Propagation of the Great Depression', *American Economic Review* **73**(3), 257–76.

Bernanke, B. S., Gertler, M. & Gilchrist, S. (1999), The financial accelerator in a quantitative business cycle framework, *in* J. B. Taylor & M. Woodford, eds, 'Handbook of Macroeconomics', Vol. 1, Elsevier, chapter 21, pp. 1341–1393.

Bernhardsen, E. & Larsen, K. (2007), 'Modelling credit risk in the enterprise sector-further development of the SEBRA model', *Norges Bank. Economic Bulletin* **78**(3), 102–108.

Bhimani, A., Gulamhussen, M. A. & Lopes, S. D.-R. (2010), 'Accounting and non-accounting determinants of default: An analysis of privately-held firms', *Journal of Accounting and Public Policy* **29**(6), 517–532.

Biais, B. & Gollier, C. (1997), 'Trade credit and credit rationing', *Review of Financial Studies* **10**(4), 903–37.

Bielecki, T. R. & Rutkowski, M. (2002), *Credit risk: modeling, valuation and hedging*, Springer.

Bofondi, M., Carpinelli, L. & Sette, E. (2013), Credit supply during a sovereign debt crisis, Temi di discussione (Economic working papers) 909, Bank of Italy, Economic Research and International Relations Area.

Bonfim, D. (2009), 'Credit risk drivers: Evaluating the contribution of firm level information and of macroeconomic dynamics', *Journal of Banking & Finance* **33**(2), 281–299.

Bonfim, D., Dai, Q. & Franco, F. (2008), 'The number of bank relationships and the cost of borrowing: an empirical study', *New Developments in Financial Modelling* **1**(1), 5–33.

Boot, A. W. A. (2000), 'Relationship banking: What do we know?', *Journal of Financial Intermediation* **9**(1), 7–25.

Bottero, M., Lenzu, S. & Mezzanotti, F. (2015), 'Sovereign debt exposure and the bank lending channel: impact on credit supply and the real economy', *Available at SSRN 2686226* .

Bunn, P. & Redwood, V. (2003), 'Company accounts based modelling of business failures and the implications for financial stability', *Bank of England Quarterly Bulletin* **43**(4), 462.

Burkart, M. & Ellingsen, T. (2004), 'In-Kind finance: A theory of trade credit', *American Economic Review* **94**(3), 569–590.

Cantillo, M. & Wright, J. (2000), 'How do firms choose their lenders? An empirical investigation', *Review of Financial Studies* **13**, 155–189.

Carey, M. S., Prowse, S. D., Rea, J. & Udell, G. (1993), The economics of the private placement market, Technical Report 166, Board of Governors of the Federal Reserve System (U.S.).

Carletti, E., Cerasi, V. & Daltung, S. (2007), 'Multiple-bank lending: diversification and free-riding in monitoring', *Journal of Financial Intermediation* **16**(3), 425–451.

Carling, K., Jacobson, T., Lindé, J. & Roszbach, K. (2007), 'Corporate credit risk modeling and the macroeconomy', *Journal of Banking & Finance* **31**(3), 845–868.

Carvalho, D., Ferreira, M. A. & Matos, P. (2015), 'Lending relationships and the effect of bank distress: Evidence from the 2007-2009 financial crisis', *Journal of Financial and Quantitative Analysis* **50**, 1165–1197.

Chodorow-Reich, G. (2014), 'The employment effects of credit market disruptions: Firm-level evidence from the 2008-09 financial crisis', *Quarterly Journal of Economics* **129**, 1–59.

Cingano, F., Manaresi, F. & Sette, E. (2013), 'Does credit crunch investments down? New evidence on the real effects of the bank-lending channel', (91).

Cole, R. A. (1998), 'The importance of relationships to the availability of credit', *Journal of Banking & Finance* **22**(6), 959–977.

Colla, P., Ippolito, F. & Li, K. (2013), 'Debt Specialization', *Journal of Finance* **68**(5), 2117–2141.

Cuñat, V. (2007), 'Trade credit: suppliers as debt collectors and insurance providers', *Review of Financial Studies* **20**(2), 491–527.

De Marco, F. (2016), 'Bank lending and the European sovereign debt crisis', *Available at SSRN European 2673967* .

Degryse, H. & Ongena, S. (2001), 'Bank relationships and firm profitability', *Financial Management* **30**(1).

Demirovic, A. & Thomas, D. C. (2007), 'The relevance of accounting data in the measurement of credit risk', *European Journal of Finance* **13**(3), 253–268.

Denis, D. J. & Mihov, V. T. (2003), 'The choice among bank debt, non-bank private debt, and public debt: evidence from new corporate borrowings', *Journal of Financial Economics* **70**(1), 3–28.

Detragiache, E., Garella, P. & Guiso, L. (2000), 'Multiple versus single banking relationships: Theory and evidence', *Journal of Finance* **55**(3), 1133–1161.

Diamond, D. W. (1984), 'Financial intermediation and delegated monitoring', *Review of Economic Studies* **51**(3), 393–414.

Duffie, D., Saita, L. & Wang, K. (2007), 'Multi-period corporate default prediction with stochastic covariates', *Journal of Financial Economics* **83**(3), 635–665.

Fabbri, D. & Menichini, A. M. C. (2010), 'Trade credit, collateral liquidation, and borrowing constraints', *Journal of Financial Economics* **96**(3), 413–432.

Fama, E. & French, K. (2002), 'Testing trade-off and pecking order theory about dividends and debt', *Review of Financial Studies* **15**, 133.

Farinha, L. A. & Santos, J. A. C. (2002), 'Switching from single to multiple bank lending relationships: Determinants and implications', *Journal of Financial Intermediation* **11**(2), 124–151.

Fazzari, S., Hubbard, R. G. & Petersen, B. C. (1987), Financing constraints and corporate investment, Technical report, National Bureau of Economic Research.

Ferris, J. S. (1981), 'A transactions theory of trade credit use', *The Quarterly Journal of Economics* pp. 243–270.

Fisman, R. & Love, I. (2003), 'Trade credit, financial intermediary development, and industry growth', *Journal of Finance* **58**(1), 353–374.

Fok, R. C., Chang, Y.-C. & Lee, W.-T. (2004), 'Bank relationships and their effects on firm performance around the Asian financial crisis: Evidence from Taiwan', *Financial Management* **33**(2), 89–112.

Frank, M. & Goyal, V. (2003), 'Testing the pecking order theory of capital structures', *Journal of Financial Economics* **67**, 217–248.

Frank M, Goyal V. (2008), Tradeoff and pecking order theories of debt, *in* 'The Handbook of CorporateFinance: Empirical Corporate Finance', Vol. 2, Elsevier, chapter 12.

Giannetti, M., Burkart, M. & Ellingsen, T. (2011), 'What you sell is what you lend? Explaining trade credit contracts', *Review of Financial Studies* **24**(4), 1261–1298.

Gomes, A. & Phillips, G. (2012), 'Why do public firms issue private and public securities?', *Journal of Financial Intermediation* **21**(4), 619–658.

Graham, J. R. & Leary, M. T. (2011), 'A review of empirical capital structure research and directions for the future', *Annual Review of Financial Economics* **3**(1), 309–345.

Hadlock, C. J. & James, C. M. (2002), 'Do banks provide financial slack?', *Journal of Finance* **57**(3), 1383–1419.

Harhoff, D. & Korting, T. (1998), 'Lending relationships in Germany - Empirical evidence from survey data', *Journal of Banking & Finance* **22**(10-11), 1317–1353.

Holmstrom, B. & Tirole, J. (1997), 'Financial intermediation, loanable funds, and the real sector', *Quarterly Journal of Economics* **112**(3), 663–91.

Hoshi, T., Kashyap, A. & Scharfstein, D. (1990), 'The role of banks in reducing the costs of financial distress in Japan', *Journal of Financial Economics* **27**(1), 67–88.

Houston, J. F. & James, C. M. (2001), 'Do relationships have limits? Banking relationships, financial constraints, and investment', *Journal of Business* **74**(3), 347–374.

Houston, J. & James, C. (1996), 'Bank information monopolies and the mix of private and public debt claims', *Journal of Finance* **51**(5), 1863–1889.

Ivashina, V. & Scharfstein, D. (2010), 'Bank lending during the financial crisis of 2008', *Journal of Financial Economics* **97**(3), 319–338.

Iyer, R., Peydró, J.-L., da Rocha-Lopes, S. & Schoar, A. (2014), 'Interbank liquidity crunch and the firm credit crunch: Evidence from the 2007−2009 crisis', *Review of Financial Studies* **27**(1), 347–372.

Jacobson, T., Lindé, J. & Roszbach, K. (2013), 'Firm default and aggregate fluctuations', *Journal of the European Economic Association* **11**(4), 945–972.

Jarrow, R. & Turnbull, S. (1992), 'Credit risk: Drawing the analogy', *Risk Magazine* **5**(9), 63–70.

Jensen, M. & Meckling, W. H. (1976), 'Theory of the firm: Managerial behavior, agency costs and ownership structure', *Journal of Financial Economics* **3**(4), 305–360.

Johnson, S. A. (1997), 'An empirical analysis of the determinants of corporate debt ownership structure', *Journal of Financial and Quantitative Analysis* **32**(01), 47–69.

Kim, M., Kliger, D. & Vale, B. (2003), 'Estimating switching costs: the case of banking', *Journal of Financial Intermediation* **12**(1), 25 – 56.

King, R. G. & Levine, R. (1993), 'Finance and growth: Schumpeter might be right', *Quarterly Journal of Economics* **108**(3), 717–737.

Klapper, L., Laeven, L. & Rajan, R. (2012), 'Trade credit contracts', *Review of Financial Studies* **25**(3), 838–867.

Kraus, A. & Litzenberger, R. H. (1973), 'A state-preference model of optimal financial leverage', *Journal of Finance* **28**(4), 911–922.

Lacerda, A. I. & Moro, R. A. (2008), Analysis of the predictors of default for Portuguese firms, Working Papers w200822, Banco de Portugal, Economics and Research Department.

Langfield, S. & Pagano, M. (2015), Bank bias in Europe: Effects on systemic risk and growth, Working Paper 1797, European Central Bank.

Love, I. (2003), 'Financial development and financing constraints: International evidence from the structural investment model', *Review of Financial studies* **16**(3), 765–791.

Mark Gertler, S. G. (1994), 'Monetary policy, business cycles, and the behavior of small manufacturing firms', *Quarterly Journal of Economics* **109**(2), 309–340.

Merton, R. C. (1974), 'On the pricing of corporate debt: The risk structure of interest rates', *Journal of Finance* **29**(2), 449–470.

Modigliani, F. & Miller, M. (1958), 'The cost of capital, corporate finance and the theory of investment', *American Economic Review* **48**, 261297.

Modigliani, F. & Miller, M. (1963), 'Corporate income taxes and the cost of capital: a correction', *American Economic Review* **53**, 433443.

Moody's (2004), 'The Moody's KMV EDF Riskcalc v3.1 Model'.

Myers, S. (1984), 'The capital structure puzzle', *Journal of Finance* **39**, 575–592.

Myers, S. C. & Majluf, N. S. (1984), 'Corporate financing and investment decisions when firms have information that investors do not have', *Journal of Financial Economics* **13**(2), 187–221.

Nilsen, J. H. (2002), 'Trade credit and the bank lending channel', *Journal of Money, Credit and Banking* **34**(1), 226–253.

Ongena, S. & Smith, D. C. (1998), Macmillan Press, chapter Quality and duration of bank relationships, pp. 224–235.

Pesaran, M. H., Schuermann, T., Treutler, B.-J. & Weiner, S. M. (2006), 'Macroeconomic dynamics and credit risk: A global perspective', *Journal of Money, Credit and Banking* **38**(5), 1211–1261.

Petersen, M. A. & Rajan, R. G. (1994), 'The benefits of lending relationships: Evidence from small business data', *Journal of Finance* **49**(1), 3–37.

Petersen, M. A. & Rajan, R. G. (1997), 'Trade credit: Theories and evidence', *Review of Financial Studies* **10**(3), 661–91.

Popov, A. & Horen, N. V. (2015), 'Exporting sovereign stress: Evidence from syndicated bank lending during the Euro Area sovereign debt crisis', *Review of Finance* **19**(5), 1825–1866.

Rajan, R. G. (1992), 'Insiders and outsiders: the choice between informed and arm's-length debt', *Journal of Finance* **47**(4), 1367–1400.

Rajan, R. & Zingales, L. (1995), 'What do we know about capital structure?', *Journal of Finance* **50**, 1421–1460.

Rauh, J. D. & Sufi, A. (2010), 'Capital structure and debt structure', *Review of Financial Studies* **23**(12), 42424280.

Schwartz, R. A. (1974), 'An economic model of trade credit', *Journal of Financial and Quantitative Analysis* **9**(04), 643–657.

Sharpe, S. A. (1990), 'Asymmetric information, bank lending, and implicit contracts: A stylized model of customer relationships', *Journal of Finance* **45**(4), 1069–1087.

Soares, M. C. (2006), 'Modelling of an indicator for credit scoring of non-financial corporations–a preliminary research based on discriminant analysis', *Financial stability report, Banco de Portugal* .

Stiglitz, J. E. & Weiss, A. (1981), 'Credit rationing in markets with imperfect information', *American Economic Review* **71**(3), 393–410.

Von Thadden, E.-L. (2004), 'Asymmetric information, bank lending and implicit contracts: the winner's curse', *Finance Research Letters* **1**(1), 11–23.